NAS 1.9/4:
813

Scientific and Technical Aerospace Reports

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

FEBRUARY 8, 1970

VOLUME 8 • NUMBER 3

N70-12705—N70-14104

PUBLIC DOCUMENTS DEPT.

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Scientific and Technical Aerospace Reports, Volume 8, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966.

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02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **390**

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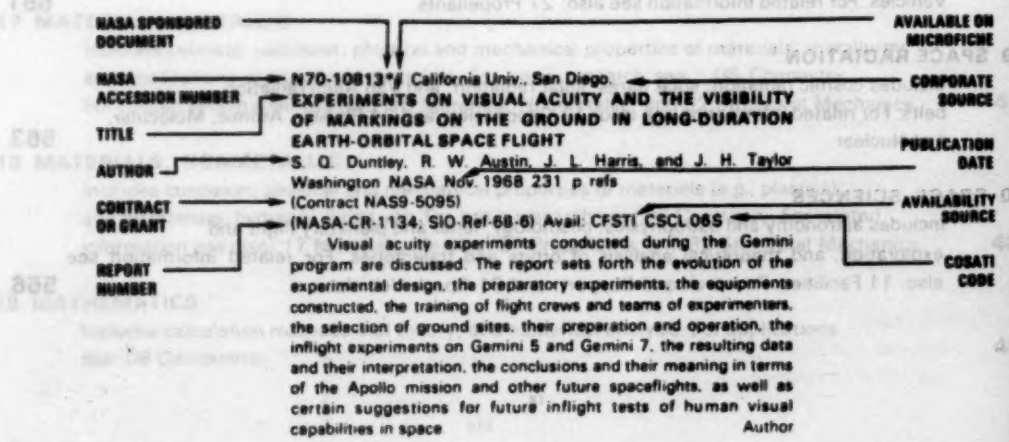
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EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
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REPORT NUMBER
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space
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VOLUME 8 NUMBER 3 / FEBRUARY 8, 1970

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

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N70-12989# National Aeronautical Lab., Bangalore (India).
KINEMATICALLY CONSISTENT UNSTEADY AERODYNAMIC COEFFICIENTS IN SUPERSONIC FLOW. PART 2: APPLICATION OF TRIANGULAR ELEMENTS
J. Nagabushan Kariappa (Hindustan Aeronaut., Ltd.) and P. S. Anantharam Mar. 1968 111 p refs
(NAL-TN-9-Pt-2) Avail: CFSTI

This paper uses triangular elements as the basic elements in the derivation of the aerodynamic influence matrices in the unsteady case. A few numerical calculations on two types of delta wings both in steady and unsteady cases were carried out, using throughout a coarse grid system. Lift and moment distributions along spanwise direction were compared with the available results. Author

N70-12990# National Aeronautical Lab., Bangalore (India).
KINEMATICALLY CONSISTENT UNSTEADY AERODYNAMIC COEFFICIENTS IN SUPERSONIC FLOW. PART 1: THEORETICAL BASIS
J. Nagabushan Kariappa Mar. 1968 13 p refs
(NAL-TN-9-Pt-1) Avail: CFSTI

A finite element approach to determine the aerodynamic influence coefficients consistent with the stiffness and inertia properties of a flying vehicle in supersonic flow is presented. This is basically a kinematic method which reduces the dynamical equations of a non-conservative system to a simple and elegant form. This approach amalgamates the disciplines of matrix algebra, and is essentially suitable for a modern high speed digital computer. Author

N70-13206*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL DETERMINATION OF EQUIVALENT SOLID BODIES TO REPRESENT JETS EXHAUSTING INTO A MACH 2.20 EXTERNAL STREAM
Lawrence E. Putnam and Francis J. Capone Washington Dec. 1969 67 p refs
(NASA-TN-D-5553; L-6707) Avail: CFSTI CSCL 01A

An inverse application of the method of characteristics for potential axially symmetric flow was developed to calculate an equivalent solid body which will produce the same interference pressure field as an axially symmetric jet exhausting into a supersonic stream. An experimental investigation was also made at a Mach number of 2.20 to obtain measurements of local Mach number, flow angle, and pressure in the flow field of cold air jets exhausting from various axially symmetric nozzle configurations. These flow-field measurements were used in calculations of equivalent solid bodies to represent jet exhaust plumes for various nozzle operating conditions. A comparison of the flow fields produced by two jet equivalent solid bodies and flow fields of the corresponding jet plumes showed good agreement and verified the present concept of representing a jet plume by an equivalent solid body. Author

N70-13240# Sandia Corp., Albuquerque, N. Mex.
WIND TUNNEL STATIC FORCE TESTS OF FIVE WEDGE-FIN TOMAHAWK CONFIGURATIONS AT MACH NUMBERS OF 0.6 TO 11.3 (TESTS 3-150 AND 6-42)
D. E. Berg Jul. 1969 166 p refs
(PB-184917; SC-TM-69-301) Avail: CFSTI CSCL 19G

Tests were conducted in the Sandia Laboratories Trisonic and Hypersonic Wind Tunnels to obtain basic aerodynamic data for five wedge-fin Tomahawk configurations. The tests were conducted over a nominal Mach number range of 0.6 through 11.3 at angles of attack from −8 degrees to +15 degrees. The test procedures are described and the data are presented in graphical and tabular form. Author (USGRDR)

N70-13358*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY OF THE APPLICATION OF HEAT OR FORCE FIELDS TO THE SONIC-BOOM-MINIMIZATION PROBLEM
David S. Miller and Harry W. Carlson Washington Dec. 1969 18 p refs
(NASA-TN-D-5582) Avail: CFSTI CSCL 01A

Schemes purporting to offer a solution to the sonic boom problem by application of a heat or force field to alter the airflow about an airplane in supersonic flight have been advanced and have received a considerable amount of attention, not only in the scientific community but also in the popular press. In this report, the basic concepts of the schemes are related to the known body of information concerning sonic-boom generation, and a variety of problems which would be encountered in attempts at practical application of these schemes are brought out. In addition, a preliminary estimate of the power requirements for a representative supersonic transport is made. Author

N70-13472# Council for Scientific and Industrial Research, Pretoria (South Africa). National Mechanical Engineering Research Inst.
DESIGN OF CONES FOR FREE-FLIGHT DYNAMIC STABILITY TESTS
M. E. Beyers Jan. 1968 24 p refs
(MEG-632) Avail: CFSTI

An analytical study of simplified free-flight models was made in order to determine the effect of model parameters on flight trajectory in a trisonic wind tunnel. Optimum mass distributions and model dimensions were derived for the design of a free-flight cone. Author

N70-13604# Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Aachen (West Germany). Inst. für Theoretische Gasdynamik.
FUNDAMENTALS OF FLUID THERMODYNAMICS [ABRISS DER STROEMUNGSTHERMODYNAMIK]
K. Oswatitsch Sep. 1969 97 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-59) Avail: CFSTI

For use in fluid mechanics, an outline of thermodynamics is developed for ideal gases, gases with phase change, dissociation, ionisation and chemical reactions in general. Thermodynamic equilibrium between two substances and relaxation processes are explained. This leads to a 'two-substances-model', which is particularly suitable for the presentation of a number of thermodynamic processes occurring in fluid mechanics, i.e. dissociation, shock waves, combustion and detonation etc. Finally, radiation of gases is briefly treated. Author (ESRO)

N70-13661# Kyota Univ., (Japan). Dept. of Aeronautical Engineering.
MEASUREMENTS OF THE HYPERSONIC AERODYNAMIC CHARACTERISTICS FOR SEVERAL KINDS OF WAVE RIDERS
G. Kamimoto and Y. Uenaka Dec. 1968 30 p refs
(CP-25) Avail: CFSTI

This paper reports on wind-tunnel studies of wave riders which might form the basis of future hypersonic aircraft. Eleven kinds of models are tested such as simple caret wings, halved Maikapar bodies and some special configurations. Lift and Drag coefficients, Lift-Drag ratios, shock shapes and pressure distributions are measured using the Kyoto University New Hypersonic Gun Tunnel. Furthermore, the experimentally obtained data are comparec with the theoretical value calculated by two dimensional theory. Author

N70-13859# General Applied Science Labs., Inc., Westbury, N.Y.
EXPERIMENTAL EVALUATION OF VEHICLE DRAG IN LONG TUBES Final Report
Daniel E. Magnus, Sergio Panunzio, and Hector Medecki May 1969 129 p refs
(Contract DOT-FR-9-0011)
(PB-185707) Avail: CFSTI CSCL 13F

Experimental results for aerodynamic phenomena in high-speed tube vehicle transportation systems is reported. The data is obtained from a sealed facility which is suitable for a broad range of operating conditions and vehicle configurations. Seven vehicle configurations were used to measure vehicle drag force and the histories of static and dynamic pressure. The results correspond to full scale vehicles approximately 8 to 13 feet in diameter operating in an evacuated tube 7 miles long. The history of static wall pressure in the far field is analyzed and related to the propagation of disturbances along the tube. The pressure was measured in the region of the near field, and the results compared for various geometries of the vehicle. Author (USGRDR)

N70-13924# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Inst. für Angewandte Gasdynamik.
QUASI-ONE-DIMENSIONAL CALCULATION OF SONIC REFERENCE POINTS FOR NONEQUILIBRIUM NOZZLE FLOWS [QUASI-EINDIMENSIONALE BERECHNUNG DER SCHALLSTELLENGROESSEN BEI NICHTGLEICHGEWICHTS-DUESENSTROEMUNGEN]
Klaus Robert Aug. 1969 42 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-51; DVL-883) Avail: CFSTI

In dealing with nonequilibrium flows, the 'frozen speed of sound' is used for reference. Accordingly, 'sonic' or 'reference' points are defined as those where the flow speed of the gas equals its local frozen sonic value. The theoretical aspects of determining such sonic points as well as the corresponding thermodynamic and gasdynamic variables are discussed. A numerical method for calculating these variables for steady, quasi-one-dimensional nonequilibrium flows of a diatomic, homonuclear gas is described. Finally the numerical results relating to a special nozzle configuration and dissociating nitrogen are discussed. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-12733*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL STUDY OF EFFECTS OF SEVERE TURBULENCE ON FLIGHT MOTIONS OF A TYPICAL SUBSONIC JET-TRANSPORT AIRPLANE
William D. Grantham and Mary S. Adams Washington Dec. 1969 71 p refs
(NASA-TN-D-5573; L-5990) Avail: CFSTI CSCL 01C

An analytical investigation has been made to determine whether the inherent rigid-body, uncontrolled stability and response characteristics of subsonic jet-transport airplanes could result in a gross upset when the airplane was flying in severe turbulence; and, if so, what techniques might aid in the prevention of possible upsets from this cause. The investigation consisted mainly of calculations of the motions of an airplane when flown through a number of different samples of severe turbulence. Author

N70-12769*# Techtran Corp., Glen Burnie, Md.
FLIGHT TESTS WITH A GUST ALLEVIATION DEVICE: DESIGN ANALYSIS [ESSAI EN VOL D'UN DISPOSITIF ABSORBEUR DE RAFALES. CONFIGURATION DU SYSTEME-ANALYSE]
J. Boujot Washington NASA Dec. 1969 10 p refs Transl. into ENGLISH from ONERA-TP-698 Presented at AGARD Meeting on Aeroelastic Effects and Their Influence on the Mech. of Flight, Marseille, 21 – 24 Apr. 1969
(Contract NASw-1695)
(NASA-TT-F-12723; ONERA-TP-698) Avail: CFSTI CSCL 01C

Minimizing the response of an aircraft to atmospheric turbulence is attempted through automatic commands of the usual control surfaces without modifying the aircraft flight characteristics. For this purpose, flight control inputs are defined by a convolution of the vertical component of turbulence with a workable optimum function. Applied to a delta wing aircraft, the general theory suggests a very simple gust alleviation device. The data obtained indicate that the responses to turbulence are much improved by this device. Author

N70-12825# National Research Council of Canada, Ottawa (Ontario). National Aeronautical Establishment.
FLIGHT ASSESSMENT OF A VARIABLE-STABILITY HELICOPTER FOR STOL SIMULATIONS AND EVALUATION OF THE INFLUENCE OF SEVERAL LATERAL-DIRECTIONAL STABILITY DERIVATIVES
D. M. Mc Gregor Jun. 1969 29 p refs
(NRC-NAE-LR-524; NRC-10953) Avail: CFSTI

A particular STOL aircraft (the Otter) was simulated using

a variable-stability helicopter to assess the simulator's capabilities in duplicating the flight characteristics of this class of aircraft. Direct comparisons were made by the pilots through alternate flights in the simulator and on the actual aircraft, and it was concluded that a very convincing simulation could be effected, particularly with respect to lateral-directional characteristics. Using the Otter as the base condition, several lateral-directional stability derivatives were varied to investigate their influences on the handling qualities during a low speed visual maneuvering and approach task. The results of these investigations are presented in the form of pilot opinion data. Author

N70-12904*# Southampton Univ. (England). Inst. of Sound and Vibration Research.

HELICOPTER ROTOR NOISE. PART 1: THEORETICAL INVESTIGATION OF ROTATIONAL NOISE Final Report

H. K. Tanna Mar. 1969 32 p refs

(Grant NGR-52-025-002)

(NASA-CR-66870; ISVR-283) Avail: CFSTI CSCL 01C

Existing rotational noise theories are surveyed and evaluated for their usefulness in rotor blade design considerations. The presence of fluctuating forces on rotor blades due to nonuniform inflow was found to be the critical factor in rotational noise generation. As a result, a computational study of rotational noise was conducted to determine the properties of a single blade loading harmonic and to obtain trends of radiation due to composite blade loading spectra. A description and physical interpretation of computed results are given. M.H.E.

N70-13083*# Advisory Group for Aerospace Research and Development, Paris (France).

THE USE OF PILOT RATING IN THE EVALUATION OF AIRCRAFT HANDLING QUALITIES

George E. Cooper (NASA. Ames Res. Center) and Robert P. Harper, Jr. (Cornell Aeron. Lab.) Apr. 1969 55 p refs Sponsored in part by NASA

(AGARD-567) Avail: CFSTI CSCL 01C

Pilot rating scales and their use in assessing aircraft handling qualities are reviewed historically, and objections that have been raised to limitations of earlier scales are considered in the development of a revised scale. Terminology used in the evaluation of handling qualities is reviewed and new definitions are proposed to improve communication and international understanding. Of particular significance is the new definition of handling qualities, which emphasizes the importance of factors that influence the selection of a rating other than stability and control characteristics. The experimental use of pilot rating is discussed in detail, with special attention devoted to (1) clarifying the difference between mission and task, (2) identifying what the rating applies to, (3) considering the pilot's assessment criteria, and (4) defining the simulation situation. The important elements of the report are then summarized in a suggested "Briefing Guide," designed for guidance in planning and executing handling qualities experiments. Author

N70-13137# Advisory Group for Aerospace Research and Development, Paris (France).

AIRCRAFT ENGINE NOISE AND SONIC BOOM

May 1969 563 p refs Held at Saint-Louis, France, 27-30 May 1969

(AGARD-CP-42) Avail: CFSTI

The generation, propagation, and effects of aircraft engine noise and sonic booms were studied with the aim to minimize acoustic effects. Presented studies covered the state-of-the-art in both the aerodynamic and propulsion areas of the field. For detailed individual studies see N70-13137 through N70-13169.

N70-13138# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

THE PHYSICS OF AERODYNAMIC NOISE

G. M. Lilley *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 14 p refs (See N70-13137 03-02)

Avail: CFSTI

The theory of aerodynamic noise was formulated by Lighthill in 1953. The theory of the noise from rotating machinery such as propeller and compressor noise can be developed along similar lines by the introduction of suitable source terms in Lighthill's general formulation. Thus in all aerodynamic noise problems the far field pressure distribution is found as a solution of the wave equation with a right hand side forcing function. This applies to flow fields at both subsonic and supersonic speeds. The present paper not only sets out the unified theory of aerodynamic noise involving random disturbances in the flow, but also shows how the theory can include the analysis of the pressure fields from bodies traveling through otherwise undisturbed air at subsonic and supersonic speeds, and therefore includes the theoretical background for the treatment of the sonic boom problem for generalised aircraft motions. Author

N70-13139# Advisory Group for Aerospace Research and Development, Paris (France).

A BRIEF LEGAL HISTORY OF THE SONIC BOOM IN AMERICA

J. P. Taylor and E. R. G. Taylor *In its* Aircraft Engine Noise and Sonic Boom May 1969 13 p (See N70-13137 03-02)

Avail: CFSTI

Leading world air carriers are now making detailed plans involving commercial supersonic transports (SST's). The legal consequences of such flights may well turn out to be as complex, in their own way, as the development of the aircraft itself. In this paper sonic booms and their effects on man and his structures are examined through material available from administrative claims and court cases. Several recent Congressional actions and early response thereto by the Department of Transportation, and Federal Aviation Administration insofar as the sonic boom is concerned, are briefly described. Author

N70-13140# Federal Aviation Administration, Washington, D.C.

AIRPORT DESIGN AND OPERATION FOR MINIMUM NOISE EXPOSURE

Isaac H. Hoover and Donald G. Cochran *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 22 p refs (See N70-13137 03-02)

Avail: CFSTI

Regulatory action in a number of countries and standards in the International Civil Aviation Organization (ICAO) will result in significantly reduced maximum noise levels for new aircraft entering the world's air carrier fleets. This paper examines the expected noise exposures to be generated by commercial aircraft operating in the next decade and reviews significant considerations in the location of new airports, the land requirements of existing and new airports as a function of the type service, and airport design in terms of runways and necessary support facilities to minimize noise exposure. The potential of existing and developing operational practices and restrictions to minimize noise are assessed. Finally, the forecasting of aircraft noise exposure near airports and its relationship to the development of compatible land use programs and public relations/education programs are discussed. Author

N70-13141# Technische Hochschule Hannover (West Germany).

PROBABILITY OF AIRCRAFT NOISE AND SONIC BOOM INDUCED BUILDING DAMAGES

Gunter Weber *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 8 p (See N70-13137 03-02)

Avail: CFSTI

Buildings are calculated for certain static deadloads and payloads, prescripted by building standards. Aircraft noise and sonic

booms are transient supplement loads, neglected in calculation. Scope of this paper is the evaluation of the ratio of calculated static main stresses to dynamic supplement stresses induced by aircraft noise and sonic booms. Aircraft noise with sound pressure levels from 81 dB to 92 dB produced stresses up to 0.8 kp/sq cm in glass panes of a multistory building allowable stresses in glass panes 300 kp/sq cm. Damages therefore will follow a certain order: Primary structures like walls, staircases etc. only could be influenced if before parts of the roof would be damaged. Tiles on the roof would crack before purlins and rafters would reach their stress limit. Glass panes would break before damage on roofs would happen. Unsound plaster with adhesive strength approaching zero would fall off at first. Damages on primary structures of buildings are till now known and are not to be expected. Author

N70-13142# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

HUMAN RESPONSE TO SONIC BOOMS

H. E. von Gierke and C. W. Nixon *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 17 p refs (See N70-13137 03-02)

Avail: CFSTI

This paper reviews the results of the various observations, overflight programs, experimental field and laboratory tests, which form the basis for present day estimates regarding the acceptability of sonic booms by man. The loudness and annoyance of individual booms and their dependence on the boom overpressure and pressure time function as well as the complex reaction of individuals, groups and cities exposed to sonic booms of varied magnitude and frequency are discussed. The few experiments available proving that even sonic booms of the maximum intensity presently feasible cannot produce any direct medical injury are described. Based on the integrated body of results of recent physiological, psychoacoustic, behavioral and sociological studies in various countries, estimates of the effects and acceptability of regular, frequent supersonic commercial overland flight schedules are presented and discussed in terms of aircraft noise pollution in general and of potential certification of aircraft with respect to noise and sonic boom. Author

N70-13143# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

TURBOFAN ENGINE NOISE: MECHANISMS AND CONTROL

Colin G. Gordon *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 13 p refs (See N70-13137 03-02)

Avail: CFSTI

At the exhaust flow velocities typical of current turbofan engines, a number of source mechanisms for broadband noise generation can be postulated. These sources exist within the engine and act in addition to the more classical sources of jet noise that arise in the turbulent exhaust stream. Data are presented from laboratory studies that illustrate the importance and suggest the parametric dependence of some of these sources. These sources seem to play a particularly significant role in the turbine and fan exhaust ducts of an engine a role which may be augmented, rather than diminished by current techniques of engine quieting. There is much to be learned about these sources before their significance in current and projected engine designs can be properly understood. Part of this understanding may derive from careful and systematic studies of current vehicles. Some ideas are suggested for such a study. Author

N70-13144# National Gas Turbine Establishment, Pyestock (England).

NOISE ASSOCIATED WITH SHOCK WAVES IN SUPERSONIC JETS

D. L. Martlew *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 12 p refs (See N70-13137 03-02)

Avail: CFSTI

Current methods for predicting the field of noise around a jet are not adequate to explain observations of high noise levels in directions at large angles to supercritical jets in motion. Experiments on static jets in the anechoic chamber suggest that part, at least, of this "forward throw" of noise may be due to the presence of a regular shock cell structure in the jet. Noise fields are compared for jets with and without shock cells and similarities are pointed out between the phenomenon of jet screech due to shock cell oscillation and the forward throw of broad band noise. Limited tests with a plug nozzle show that this type produces less forward noise, probably owing to differences in the shock system which is of small extent and irregular in comparison with that of a convergent nozzle. It is concluded that the elimination of the shock cell pattern could reduce jet noise forward of the nozzle by 10 dB. Author

N70-13145# Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.

JET NOISE FROM MOVING AIRCRAFT

John E. Ffowcs Williams *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 8 p refs (See N70-13137 03-02)

Avail: CFSTI

Presented is an equation that specifies the sound field of the noise from turbulence convected at high speed by the mean square density radiated to large distances from turbulence that is stationary in time in a frame of reference moving with a velocity relative to the air at rest. The acoustic intensity at distant observation points varies with observation time because the source region as a whole is in motion with a certain velocity. A very complete specification of the sound field is obtained with a minimum of approximation. Ignored are those nonradiating parts of the density field that fall off more rapidly, viscous stresses; assumed is an eddy with a well defined convection velocity relative to the outside environment. G.G.

N70-13146# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DETERMINATION OF SOUND FIELD PRODUCED BY CHANGING AIRPLANE PROCESSES [DETERMINATION DU CHAMP SONORE PRODUIT PAR L'EVOLUTION DES AVIONS A REACTION]

M. Kobrynski *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 13 p refs In FRENCH (SEE N70-13137 03-02)

Avail: CFSTI

Total sound fields produced by a stationary rotating jet and those produced by a moving jet, observed from a fixed point, are analyzed in the context of global sound fields. A new convection index derived from Ribner's expression is developed which confirms previous findings on the direction of the maximum acoustical stream (theta sub M) and improves predictions in the other directions. Velocity of flight influences on sound production in large fan-shaped angles (20 deg to 160 deg with reference to the axis of the jet) is considered. The relationship between turbulence convection effects in stationary and moving jets, and acoustic power variations produced by the jet forward motion in the atmosphere is deduced. Analytical results supported by experiments showed that in different angles of theta sub M, relative velocity is not a significant parameter in determining the levels of global sound fields. Transl. by M.H.E.

N70-13147# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).

ACOUSTIC INTERFERENCE BY REFLECTION: APPLICATION TO THE SOUND PRESSURE SPECTRUM OF JETS [ETUDE DES INTERFERENCES ACOUSTIQUES PAR REFLEXION. APPLICATION AUX SPECTRES DE PRESSION ACOUSTIQUE DES JETS]

P. Thomas *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 20 p refs In FRENCH (See N70-13137 03-02)

Avail: CFSTI

Theoretical and experimental studies of the interfering reflection phenomena which distort acoustic measurements and some fundamental relations for developing applicable correction factors were evaluated. Two hypotheses were examined: that of white noise, and that of the actual source. Each was found to be valid in describing jet noise distribution characteristics assuming a perfectly reflecting surface. The phenomena of interferences are altered when the jet is near the surface and under certain sustained generator conditions. Transl. by M.H.E.

N70-13151# France. Service Technique de l'Aeronautique, Paris.
FLIGHT TESTING OF MIRAGE 4 [ESSAIS MIRAGE 4]
M. I. C. Wanner *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 19 p refs In FRENCH (See N70-13137 03-02)
Avail: CFSTI

Two experimental programs, l'Operation Jericho – Virage and Jericho – Focalization measured amplification coefficients when focalization occurs in normal flight at altitudes approaching 36,000 feet. Rectilinear acceleration and accelerated turning which produce sonic booms at different stratospheric levels demonstrated the focalization phenomena. Acoustic propagation calculations were made from the real trajectory of the airplane, assuming standard atmospheric conditions except for temperature and wind measured onboard the aircraft. Parameters which predict the occurrence of focalization are reported of the order of 5 coefficients of amplification. Transl. by M.H.E.

N70-13152*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SURVEY OF UNITED STATES SONIC BOOM OVERFLIGHT EXPERIMENTATION
John O. Powers (FAA, Washington, D.C.), J. M. Sands (FAA, Washington, D.C.), and Domenic J. Maglieri *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 36 p refs (See N70-13137 03-02)
Avail: CFSTI CSCL 01C

Programs of supersonic overflight experimentation have been conducted to improve our knowledge and understanding of the sonic boom; the present paper intents to add new and recent material which will, in effect, update the previous papers. In addition, some recent developments in the claims and legal activity associated with this experimentation obtain an up-to-date view of the legal and social costs associated with the test programs. Other recent developments in the field of sonic boom overpressure measuring instrumentation and in the theoretical methods of signature prediction are included. These developments are expected to facilitate future sonic boom over-flight studies and will enhance the ability to theoretically interpret the resulting experimental findings. Author

N70-13153# Boeing Scientific Research Labs., Seattle, Wash.
AN ANALYSIS OF DEVICES FOR REDUCING SONIC BOOM
Sin-I Cheng and Arnold Goldburg *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 14 p refs (See N70-13137 03-02)
Avail: CFSTI

Techniques to apply electro-kinetic forces and to add thermal energy to the flow field around a supersonic transport have been proposed to alter the shock configuration and thereby to reduce sonic boom. Concepts advanced so far for the aerodynamic interactions are deficient in that an intensive interaction in more than one spatial dimension between the electric discharge or combustion over the nose and wing and the incoming supersonic flow will lead to a detached bow shock, not the attached shock of weak family claimed in the proposed schemes. The question of the specific power consumption is investigated. The estimate of the thrust generation and electric power required by the discharge is based on the analysis of a one-dimensional model whice includes the key physical processes of the electric discharge. The conclusions reached are: The electro-aerodynamic and combustion techniques currently proposed are conceptually deficient. While some configurations, to be proposed in the future, of the electro-aerodynamic devices may prove to be conceptually valid, they are technically not feasible. Efforts for reduction of boom intensity should concentrate on the development of detailed optimization of the aerodynamic design of the airplane. Author

N70-13154# Rolls-Royce, Ltd., Derby (England).
THE DEVELOPMENT OF ACOUSTIC ABSORBERS FOR TURBOFAN ENGINES
C. J. Webber *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 13 p (See N70-13137 03-02)
Avail: CFSTI

Recent proposals for legislation on maximum noise levels from aircraft emphasise the need for reduction in the noise radiated from engines. High bypass ratio engine noise is dominated by the fan and turbine sources. Noise from these components may be reduced by the application of absorbent liners to the engine ducts. The design of such liners for optimum acoustic performance requires experimental data on the behaviour of absorbent systems in a representative environment. A description is given of a high sound pressure level impedance tube, and a large scale absorption flow facility developed for this purpose. Some results for typical liner designs obtained in these rigs are presented and discussed. Author

N70-13155# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
AIRCRAFT ENGINE NOISE MEASUREMENT TECHNIQUES, FACILITIES, AND TEST RESULTS
William R. Morgan and Spiridon N. Suciu *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 16 p (See N70-13137 03-02)
Avail: CFSTI

This paper describes three basic phases of acoustic testing and analysis work necessary to advance the state of the art of quiet engine designs which, in turn, contribute to the reduction of noise emanating from aircraft. Provided is a description of types of laboratory test equipment and some important, early results that may be obtained from such equipment; far field (open field) acoustic ground test facilities and test results; and finally, flight test facilities and flight results. Throughout the paper emphasis is placed on the importance of specifying the noise requirements early so that the engine will incorporate the basic features necessary to achieve the specified noise levels at a minimum penalty in performance, weight, cost, and reliability. Also, the need is spelled out for an analytical effort closely integrated with, and parallel to, the experimental work to gain an understanding of the basic mechanisms of noise generation and suppression and to develop reliable prediction methods for system tradeoff studies and future noise level projections. Author

N70-13156# Pratt and Whitney Aircraft, East Hartford, Conn.
GENERATION AND SUPPRESSION OF COMBINATION TONE NOISE FROM TURBOFAN ENGINES
J. D. Kester *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 16 p refs (See N70-13137 03-02)
Avail: CFSTI

Advanced acoustical design features have resulted in the elimination of several sources of noise from the high bypass ratio turbofan engine being developed. With reductions in pure tone noise levels radiated out the inlet duct, combination tone noise has been uncovered as a principal remaining noise source at high powers where the fan blade tips are supersonic. Studies of the generation and propagation of this noise have been conducted on a variety of research rigs as well as on the full scale engine. Detailed mapping of the inlet duct noise field forward of a supersonic tip

speed fan has provided a basic understanding of the properties of this noise source. Substantial reductions in the level of noise from this source have been demonstrated by the installation of sound absorbing liners in the inlet ducts of turbofan engines. Results of these studies are reviewed in this paper. Author

N70-13157# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
NOISE ESTIMATION METHOD FOR A REACTION TURBOJET ENGINE BEGINNING WITH ITS THERMOPROPULSIVE SIZE [METHODE D'ESTIMATION DU BRUIT D'UN TURBOREACTEUR A PARTIR DE SESGRANDEURS THERMOPROPULSIVES]
R. Hoch and J. P. Duponchel *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 23 p refs In FRENCH (See N70-13137 03-02)
Avail: CFSTI

Noise estimation methods to be used in industry and airports during the acoustic certification of aircraft are examined for applicability to airplane turboreactors. A rapid method requiring reference to graphs is explained. Thermopropulsive equivalents are obtained from motor dimensions described on the graphs. Agreement between measured values and values calculated with this method is reported. Transl. by M.H.E.

N70-13160# Advisory Group for Aerospace Research and Development, Paris (France).
STUDY OF AIRPLANE NOISE ON TAKE-OFF [ETUDE DU BRUIT DES AVIONS AU DECOLLAGE]
Pianko Marc *In its* Aircraft Engine Noise and Sonic Boom May 1969 31 p refs (See N70-13137 03-02)
Avail: CFSTI

Optimal trajectories on take-off were studied to identify and improve airplane parameters which produce the total volume of take-off sound. The resounding qualities and relative influences of each parameter other than the motor are identified and calculated to determine the optimum point and the consequences of noise reduction. The problem of measuring airplane parameters separately, as in the noise of the jet versus the noise of the compressor, is discussed in terms of human perception of relative noisiness. Physical engine characteristics are reviewed with considerations of engine modification. Transl. by M.H.E.

N70-13161# Pisa Univ. (Italy).
GROUND CONFIGURATION EFFECTS ON SONIC BOOM
Dino Dini and Renzo Lazzeretti *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 33 p refs (See N70-13137 03-02)
Avail: CFSTI

The propagation of sonic boom generated in flight operation by a particular aircraft is most significantly affected by ground configuration, due to reflection and refraction in different distribution patterns. The theory gives a reasonably clear explanation of the sound radiation fields as well as of the reflection laws depending on incidence angles and ground configuration; the relative surfaces will act as good reflectors to sound and shock generated and radiated from a very large distance. More significant than the noise level affecting the community is the problem of the multiplying effects of the reflected shock overpressure reaching/leaving the ground. In the present paper, such effects are analysed for different ground geometries and possible overpressure values. More than twice until eight times the overpressure may be increased, but fortunately their damaging effects on man and light structures are in general sufficiently reduced. Here the results of computations are presented in tabular form regarding the cases that may occur in practice. Author

N70-13162# Environmental Science Services Administration, Silver Spring, Md.
A PRELIMINARY STUDY OF ATMOSPHERIC EFFECTS ON THE SONIC BOOM
G. A. Herbert, W. A. Hass, and J. K. Angell *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 13 p refs (See N70-13137 03-02)
Avail: CFSTI

Atmospheric effects on sonic booms generated by bomber and fighter aircraft are investigated through analysis of more than 4000 sonic-boom pressure traces obtained from a 40-microphone grid during the fall and winter of 1966 – 67. A computer program, which generates maximum overpressure values for a horizontally stratified real atmosphere, is tested against the mean observed overpressure on the grid and is shown to be in error by an average of ten percent when the maximum observed overpressure is derived from the positive impulse area. The pressure traces are grouped into 3 categories so that "spiked" signatures, which constitute the largest deviation from the mean, may be studied as a function of local weather conditions. This study shows a good correlation between the depth of the surface mixed layer and the percentage of spiked signatures. The variability of the maximum overpressure also increases with increase in low-level wind speed. Both these results suggest that turbulence in the planetary boundary layer is the main cause of spiked signatures and the associated large variation in maximum overpressure. There is some evidence that waves within an inversion contribute to overpressure variability on a larger scale. Author

N70-13163# Royal Aircraft Establishment, Farnborough (England).
THE SIMULATION OF SONIC BANGS
C. H. E. Warren *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 15 p refs (See N70-13137 03-02)
Avail: CFSTI

The various methods which have been developed for simulating sonic bangs are described. They range from explosive point charges, explosive line charges to shock-tube devices. The appropriate role of application, and its shortcomings, of each type of simulant is discussed. Some of the results that have been obtained in studies employing these devices are referred to briefly. Author

N70-13164*# National Aeronautics and Space Administration, Washington, D.C.
SONIC BOOM SIMULATION FACILITIES
Ira R. Schwartz *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 20 p refs (See N70-13137 03-02)
Avail: CFSTI CSCL 01C

The requirements for experimental research to study the generation of sonic boom pressure fields, its propagation through a stratified atmosphere and its effect on humans and structures dictate the construction of unique sonic boom simulation facilities. A variety of sonic boom simulators have been built in an effort to meet the requirements of proper simulation. This paper discusses a broad spectrum of sonic boom simulator concepts with special emphasis on wind tunnel sonic boom techniques, the low frequency noise facility, the shock tube bursting diaphram facility and the quick action-valve shock tube facility. In particular, this paper contains brief discussions of the overall design features of the facilities, their operating characteristics, their research capabilities and some research problems that are amenable to laboratory testing. The paper shows that substantial progress has been recently made in advancing the state of the art of sonic boom simulator development. Most of the requirements for sonic boom simulation and human and structural response can now be accommodated in a simple, inexpensive facility such as the quick action-valve shock tube facility. Author

N70-13165# Boeing Co., Seattle, Wash.
SONIC BOOM CONSIDERATIONS IN AIRCRAFT DESIGN
Clarence S. Howell, Armand Sigalla, and Edward J. Kane *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 9 p refs (See N70-13137 03-02)
Avail: CFSTI

Refined methods, based on modified linear aerodynamic theory,

are available to calculate the detailed sonic boom characteristics of airplanes. The use of these methods has been justified through correlation with both wind tunnel and flight test data. The techniques for estimating sonic boom pressure signatures of an airplane are reviewed and the effects of different configuration variables are shown. In particular, configuration variables and novel concepts that could lead to potentially favorable sonic boom characteristics, such as low overpressure, long rise time, and noncoalescence of shocks, are examined. Numerical examples illustrate the magnitude for potential improvement in sonic boom and the resulting effects on other airplane performance parameters. Author

N70-13166# Rolls-Royce, Ltd., Bristol (England). Engine Div.
AN APPLICATION OF QUADRUPOLE THEORY TO CORRELATE THE DIRECTIVITY AND SPECTRA OF HIGH SPEED JET NOISE
J. D. Voce and P. A. Lush *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 9 p refs Prepared in cooperation with Southampton Univ. (See N70-13137 03-02)
Avail: CFSTI

A considerable amount of experimental data has been obtained from model jets running at a wide range of velocities and temperatures. The purpose of this paper is to outline efforts being made to correlate this data, using Lighthill's quadrupole theory of jet noise generation with modifications due to high speed flow. The early part of this work showed that a theoretical model based on a distribution of randomly orientated quadrupole sources predicts the emission angle of peak intensity and the directivity of the radiation with reasonable success, but it does not predict the spectrum behaviour. Since it can be shown that the mixing region of a jet generates lateral quadrupoles with lobes aligned at 45 deg to the jet axis, a more complicated model can therefore be devised consisting of a distribution of lateral quadrupoles superimposed upon the randomly oriented quadrupole distribution. This type of model can be used to improve the prediction of spectrum behaviour and also give a better prediction of the peak intensity emission angle. However, certain discrepancies cannot be explained in terms of this model and possible reasons for this are discussed and suggestions for improvements, currently being investigated, are given. Author

N70-13167*# National Aeronautics and Space Administration, Washington, D.C.
ENGINE QUIETING: ENGINE DESIGNS
Nelson F. Rekos *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 11 p (See N70-13137 03-02)
Avail: CFSTI CSCL 01C

This paper describes a major research and development effort called the quiet engine program. The program is aimed at the development and establishment of the technology required for the design and development of a subsonic aircraft engine which produces a minimum of noise through basic changes in engine design. The results of the preliminary work conducted to date indicate that noise reductions of about 20 PNdB below the noise levels of current commercial subsonic turbofan engines, are feasible. Author

N70-13168# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
NOISE CHARACTERISTICS OF THE C-5A HEAVY LOGISTICS TRANSPORT
James A. Bair *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 10 p refs (See N70-13137 03-02)
Avail: CFSTI

The latest available community noise data from the C-5A Heavy Logistics System noise measurement program are presented. Noise measured at ground stations during take off and landing is presented and compared to predictions. Limited comparison of measured and predicted noise levels to community standards is included. The remaining portions of the C-5A noise measurement program are outlined. Author

N70-13169*# National Aeronautics and Space Administration, Washington, D.C.
ENGINE QUIETING: NACELLE ACOUSTIC TREATMENT
Nelson F. Rekos *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 12 p (See N70-13137 03-02)
Avail: CFSTI CSCL 01C

This paper describes a major research and development program directed towards reducing the fan noise radiated from the turbofan engines used in four-engine commercial transports. The reduction in fan noise is expected to be achieved by the modification of the engine nacelles and by the judicious application of acoustically absorptive materials in the fan inlet and discharge ducts. The results of ground tests conducted with full scale acoustically treated nacelles indicate that fan noise reductions on the order of 12 PNdB to 15 PNdB below the noise levels of the current subsonic turbofan engine installations are feasible. Author

N70-13234# Vitro Labs., Silver Spring, Md.
DEVELOPMENT AND TESTING OF AIR BALLAST SYSTEMS Final Technical Report, 1 Feb. 1967 – 15 Oct. 1968
Allen R. Davidson, Jr. 15 Oct. 1968 39 p refs
(Contract F19628-67-C-0192)
(AD-678090; TR-02057.02-3; AFCRL-68-0558) Avail: CFSTI CSCL 1/3

The report covers the final phase of the study of air ballast systems during which time two systems were designed, fabricated, and test flown. The primary objective of the two test flights was to verify experimentally the practicability and theoretical feasibility of air ballast systems. Because ballast bag failures were experienced in both flights, these objectives were not met. Some data on balloon temperatures and air ballast weights were obtained, however, giving some experimental verification of the air ballast equations and suggestions for future efforts in this area. Included in the report are detailed descriptions of the two air ballast systems flown and recommendations for future systems. Author (TAB)

N70-13292# RAND Corp., Santa Monica, Calif.
A COMPUTER-DRIVEN STEREO DISPLAY FOR AERIAL MANEUVER ANALYSIS
Rein Turn and H. E. Petersen Oct. 1968 56 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-678039; RM-5709-PR) Avail: CFSTI CSCL 15/2

A description is given of an on-line interactive stereoscopic display system for three-dimensional visualization of trajectories of maneuvering aircraft. The system is constructed by equipping an IBM 2250 display unit with a stereo-viewing device and using the IBM 360/40 computer to generate stereo pairs of the desired trajectories from punchcard data showing u, v, w coordinates of the aircraft at specified points in time. A display capacity of 900 points may be divided between as many as three separate trajectories. Author (TAB)

N70-13639# McDonnell-Douglas Co., Long Beach, Calif.
AIRCRAFT LANDING GEAR BRAKE SQUEAL AND STRUT CHATTER INVESTIGATION
F. A. Biehl *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 179–190 refs (See N70-13621 03-32)
Avail: CFSTI

Aircraft landing gear squeal and chatter vibration problems were investigated to determine their effects on passenger compartment vibrations, landing gear damage and brake wear. A digital computer program was used to simulate an aircraft braking stop and has demonstrated that the brake torque function is responsible for the excitation of both vibration modes. Vibration absorbers are suggested as effective attenuation devices. Author

N70-13694# Weapons Research Establishment, Salisbury (Australia). Dept. of Supply.
FURTHER PERFORMANCE TRIALS OF HIGH ALTITUDE METEOROLOGICAL PARACHUTES Technical Note
G. J. Simpson Jan. 1969 31 p refs
(TN-SAD-215) Avail: CFSTI

The concluding trials in the development of a high altitude parachute system for use with a meteorological sonde are described. The results are analysed for drag and stability performance and effects of wind shear. In the final trail a sonde was lowered from 200,000 ft with an attitude substantially not more than 10 deg away from vertical inclusive of wind shear effects. Author

N70-13722# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
CALCULATION OF THE RESPONSE OF AN AIRCRAFT TO RANDOM ATMOSPHERIC TURBULENCE. PART 2: ASYMMETRIC MOTIONS
O. H. Gerlach and M. Baarspul Apr. 1968 92 p
(VTH-139) Avail: CFSTI

This report deals with the asymmetric motions of an aircraft flying through continuous random atmospheric turbulence. The turbulence is considered to be stationary, homogeneous and isentropic and its statistical properties are described by means of two-dimensional power spectral density functions of the three orthogonal components of the gust velocity. Amongst the quantities describing the aircraft's asymmetric response to turbulence, the variances of the motion variables are emphasized. In the method used in this report, the stochastic variables are replaced by equivalent deterministic variables. This allows a rather simple computation of the variances, using a Liapunov-function. The method is illustrated by a simple numerical example, showing the influence of a lag-free automatic pilot on an aircraft's asymmetric response to atmospheric turbulence. Author (ESRO)

N70-13901*# National Aeronautics and Space Administration, Washington, D.C.
NASA ACOUSTICALLY TREATED NACELLE PROGRAM
1969 160 p refs Conf. held at Hampton, Va., 15 Oct. 1969
(NASA-SP-220) Avail: CFSTI CSCL 01C

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11. STUDIES OF ATMOSPHERIC ATTENUATION OF NOISE J. W. Little, R. L. Miller, P. B. Oncley, and R. E. Panko (Boeing Co., Seattle, Wash.) p 125 - 135 refs (See N70-13912 03-02)

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14. NASA ACOUSTICALLY TREATED NACELLE PROGRAM RESULTS R. W. Boswinkle, Jr. (NASA. Langley Res. Center) p 155 - 157 (See N70-13915 03-02)

N70-13902*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA ACOUSTICS RESEARCH
Robert W. Boswinkle, Jr. *In its* NASA Acoustically Treated Nacelle Program 1969 p 1 - 10 refs (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The NASA noise research program includes fundamentals of noise generation and propagation from aircraft components, structural response, the effects of noise on people, and sonic boom. In regard to reducing aircraft engine noise, it includes at least three approaches: reduction of noise generation, absorption of generated noise, and modification of the aircraft flight operational procedure. The second approach, absorption of generated noise, is the one that was pursued in the program which is the subject of this present conference. These NASA research efforts are part of an integrated national program. NASA has associations with many organizations in coordinating and conducting acoustics research. These associations extend throughout industry, the universities, the professional societies, and the government. Author

N70-13903*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROGRAM SCOPE AND DEFINITIONS
John G. Lowry *In its* NASA Acoustically Treated Nacelle Program 1969 p 11 - 18 ref (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The main objective was to identify promising nacelle modifications for current four-engine turbofan-powered transports that would reduce the noise under the approach path by 15 PNdB. Another equally important objective was to develop acoustic treatment technology that would be applicable to other turbofan engines including the newer high-bypass-ratio engines. Certain design constraints were placed on the modifications since they were to be considered for application to commercial transports. Although it was anticipated that the devices would provide relief during take-off and climbout, under no conditions should the modifications increase the already undesirably high take-off noise. It goes without saying that there should be no compromise in flight safety. There should be no increase in crew workload during the critical approach phase of flight because the safety of operations would be affected. Last but not least, the modified airplane must retain its economic viability. The problem then was one of designing a modification to the nacelle that was practical, that could reduce the approach noise by a substantial amount, that would have as small performance penalties as possible, and one that could be manufactured and installed at a reasonable cost. Author

N70-13904*# McDonnell-Douglas Co., St. Louis, Mo.
INTRODUCTION TO McDONNELL DOUGLAS PROGRAM
Robert E. Pendley *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 19-28 ref (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The nacelle design selected for the flight test program is described, and the background work that resulted in the selection of the design is summarized. Author

N70-13905*# McDonnell-Douglas Co., St. Louis, Mo.
PERFORMANCE AND OPERATIONS OF THE DC-8-55 AIRPLANE WITH ACOUSTICALLY TREATED NACELLES
David K. Gordon *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 29-39 (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The changes in airplane and engine performance due to the treated-nacelle installation were determined by analysis of the results of DC-8-55 flight tests and engine static tests. The results showed that the maximum range capability of the airplane was improved by approximately 3.0 percent. Changes in take-off field length and block time were minimal. The initial cruise altitude capability was calculated to be reduced approximately 500 feet. The approved speed-altitude operating envelope and load-factor limitations for the airplane were unaffected by the installation of the treated nacelles. Flight tests showed that the treated nacelles did not affect compresesor surge susceptibility. Static and inflight engine starting were also unaffected by the installation of the acoustically treated nacelles. Engine compressor air-bleed requirements for inlet anti-icing would be increased by about 30 percent for a retrofit installation of treated nacelles on DC-8 airplanes with short fan ducts. However, this additional bleed will not result in a reduction in allowable take-off thrust at sea level. At 8000 feet, the thrust loss at take-off power due to inlet anti-icing would be approximately 0.6 percent. Author

N70-13906*# McDonnell-Douglas Co., St. Louis, Mo.
FLYOVER NOISE LEVELS OF DC-8-55 AIRPLANES WITH ACOUSTICALLY TREATED NACELLES
Alan H. Marsh *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 41-62 refs (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

Effective perceived-noise levels were derived from 1/3-octave-band sound pressure levels measured at several stations under the landing and take-off flight paths. Effective perceived-noise levels, with units of effective perceived-noise decibels (EPNdB), were used to evaluate the acoustical effectiveness of the treated nacelles as installed on short-duct DC-8-55 airplanes powered by four JT3D-3B engines. Reductions in effective perceived-noise level were achieved at locations under both the landing-approach and the initial-climb take-off flight paths. Under a 3 deg landing-approach flight path at a distance of 1 nautical mile from threshold, an airplane with treated nacelles and the maximum landing gross weight of 240,000 pounds would produce 10.5 EPNdB lower noise levels than an airplane with existing nacelles. At a point beneath the initial-climb path and 3.5 nautical miles from brake release with the airplane climbing at 10 knots above the FAA take-off safety speed and maintaining rated take-off thrust, the treated nacelles on an airplane with the maximum 325,000-pound take-off gross weight would reduce the effective perceived-noise level by 3.5 EPNdB. By using a reduced-thrust initial-climb procedure in which rated take-off thrust is decreased at 1500 feet before the 3.5-nautical-mile point to the thrust required to maintain a 6-percent climb gradient, the treated nacelles on an airplane weighing 325,000 pounds at take-off would reduce the effective perceived-noise level by 5.5 EPNdB at the 3.5-nautical-mile point. Author

N70-13907*# McDonnell-Douglas Co., St. Louis, Mo.
ECONOMIC IMPLICATIONS OF RETROFITTING SHORT-DUCT DC-8 AIRPLANES WITH ACOUSTICALLY TREATED NACELLES
H. D. Whallon *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 63-74 ref (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The study compared each existing and modified model in terms of (1) annual profit and loss criteria, including taxes and profit after taxes, (2) investment, and (3) return on airplane investment. Estimates of the costs of developing, producing, and installing the treated nacelles were used as a basis for these comparisons. The effects on direct operating cost of the expected airplane performance changes and of amortization of the modification costs were also included in these estimates. The study indicated that direct operating cost would be increased between 4 and 5 percent, assuming a 5-year amortization of the retrofit cost and modification of all short-duct DC-8 airplanes. The increase in direct operating cost would be due almost entirely to amortization of the costs of modification. On the assumption that operating revenues would be the same for the existing and treated airplanes, calculation indicated that profit after taxes and Federal income taxes would be reduced 10.1 percent for 5 years, the investment book value of airplane inventory would be increased 18.5 percent, and the discounted cash flow rate of return on airplane investment would be reduced 8.2 percentage points, about a one-quarter reduction from the existing level. Author

N70-13908*# Boeing Co., Seattle, Wash.
INTRODUCTION TO THE BOEING PROGRAM
Robert H. Sawhill *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 75-83 (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The Boeing Company has developed and tested an acoustically treated engine-nacelle concept on the JT3D low-bypass turbofan engine. This treated nacelle was designed to reduce the fan noise components of the turbofan-engine noise. The primary goal was a reduction of perceived noise level of 15 PNdB during landing approach. The basic approach applied in the development of the treated nacelle was the absorption of the fan-generated engine noise by acoustic lining material. A program of analysis, model test, full-scale ground test, and subsequent full-scale flight test on a 707-320B airplane was followed in the development and testing of this nacelle. The acoustic material used, the nacelle configuration selected, and the final airplane/nacelle installation are described. Author

N70-13909*# Boeing Co., Seattle, Wash.
PERFORMANCE OF THE 707-320B AIRPLANE WITH ACOUSTICALLY TREATED NACELLES
Ralph B. Mc Cormick *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 85-94 (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The major performance effect of the Boeing designed acoustically treated nacelle on a Boeing 707-320B airplane powered by Pratt and Whitney JT3D-7 engines is a reduction in capacity-payload range of approximately 200 n. mi. The reduction is primarily due to the 3140-pound loss of available fuel displaced by the increased operating empty weight of the airplane. The nacelle configuration changes and the relation of the changes to airplane performance are described. The flight test program used to evaluate acoustic results and airplane performance is outlined. Performance effects are evaluated by comparing measured take-off distances, cruise performance, and effect on payload range of an airplane with the modified nacelles to an airplane with the existing nacelles. Author

N70-13910*# Boeing Co., Seattle, Wash.
ACOUSTIC RESULTS OF 707-320B AIRPLANES WITH ACOUSTICALLY TREATED NACELLES
Janis Atvars, R. A. Mangiarotty, and David Q. Walker *In* NASA, Washington NASA Acoustically Treated Nacelles Program 1969 p 95–108 refs (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The test airplane was a Boeing 707-320B powered by JT3D-7 engines. The effective perceived noise level reductions achieved, as demonstrated by the flight tests, were 15.5 EPNdB on landing approach, 3 EPNdB during take-off, 5.5 EPNdB during take-off with power cutback, and 3.5 EPNdB in sideline noise. Static ground test results were evaluated in terms of the perceived noise level scale. All flight test results were evaluated in terms of effective perceived noise level to account for time and tone correction factors. The principal results of the acoustic tests are presented. Author

N70-13911*# Boeing Co., Seattle, Wash.
ECONOMIC IMPLICATIONS OF RETROFITTING 707-320B AIRPLANES WITH ACOUSTICALLY TREATED NACELLES
James Fletcher *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 109–123 (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

Results are presented on a theoretical economic study that compares two fleets of Boeing 707-320B airplanes, one with and one without acoustically treated nacelles. The treated nacelle includes a two-ring treated inlet and a full-length treated fan duct. The study included evaluation of a hypothetical airline 707-320B route network operating with a representative passenger fare yield structure. The results show that the 1972 direct operating costs (DOC) will increase by about 9.2 percent, and that this increase is almost entirely due to the depreciation cost of the retrofit itself. It was found that when operating both airplane fleets at the current maximum gross take-off weight of 327,000 lb, the airplane with the treated nacelle presented some operational restrictions that produced a small reduction of revenue earning capacity. The major factor in economic return was the increase in DOC. This resulted in a reduction in return on revenue of 4.4 percent. This 4.4 percent reduction for the hypothetical carrier assumed may appear small. However, in a narrow-margin industry, a nominal cost increase can produce a drastic impact on return on investment. In the final analysis, a detailed assessment of the economic effect of a treated nacelle retrofit must be made by each of the affected airlines. Author

N70-13912*# Boeing Co., Seattle, Wash.
STUDIES OF ATMOSPHERIC ATTENUATION OF NOISE
John W. Little, Robert L. Miller, Paul B. Oncley, and Raymond E. Panko *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 125–135 refs (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

The standard on atmospheric absorption corrections, Aerospace Recommended Practice 866 (ARP 866), is discussed from the viewpoint of whether it is based on sufficiently well-established theoretical grounds and whether it fits reasonably well with experimental results. Also considered are the questions of whether other measurement factors may account for unsatisfactory results, and whether data accuracy can be improved and the range over which measurements taken be increased, either by modifying ARP 866 or by changing instrumentation and/or data processing. A flight test program is described, which was conducted to compare the acoustic and operational performance of a 707-320B airplane equipped with acoustically treated nacelles with that of the same aircraft with production nacelles installed. Sources of error and distortion in aircraft noise measurements are discussed, and attenuation coefficients are plotted. M.G.J.

N70-13913*# McDonnell-Douglas Co., St. Louis, Mo.
TECHNIQUES USED IN McDONNELL DOUGLAS SUBJECTIVE NOISE-RATING STUDIES
Lawrence E. Langdon and Richard F. Gabriel *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 137–142 refs (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

Recordings of DC-8-55 flyovers with both treated and existing nacelle configurations are being used in a psychoacoustic test. The results will be used to provide an empirical evaluation of the subjective effects of the nacelle treatment and an evaluation of existing noise-rating scales in terms of their accuracy in predicting the results of this particular change in noise spectra. Outdoor recordings were selected to represent all combinations of three nominal thrust levels (15,000, 10,000, and 5000 lb) and three heights (500, 1000, and 2500 ft) for both the treated and existing nacelle configurations. Indoor recordings of treated and existing nacelle configurations were selected for the three thrust conditions for one location. Pair-comparison tests in an anechoic chamber using 40 college-age subjects are currently in progress, all subjects having normal hearing. Pairs of noise test stimuli were constructed to provide four comparisons for each condition. Pairs were chosen to equate for order effects and existing or treated as standard. Pairs of noise stimuli are being presented to the subjects in a random order. Results will be analyzed to provide a statistical statement concerning the accuracy of the prediction of various existing scales such as EPNL, PNL, dB(A), and others. Author

N70-13914*# Boeing Co., Seattle, Wash.
TECHNIQUES USED IN BOEING SUBJECTIVE NOISE-RATING STUDIES
John W. Little, James E. Mabry, Norman A. Yeowart, and S. S. Stevens (Harvard Univ.) *In* NASA, Washington NASA Acoustically Treated Nacelle Program 1969 p 143–153 refs (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

A field test approach was used, with the main noise stimuli being level flyovers of both an existing 707 airplane and a 707 airplane treated for noise reduction. Annoyance judgments were also obtained for routine airplane flyovers and for random noise presented over loudspeakers. Six groups of 30 persons judged all the noises at six different listening positions. Three of the listening positions were inside trailers (one directly under the flight path and two at sidelines 1000 and 1500 feet from the flight path). The other three were outside listening positions adjacent to each of the three trailers. Judgments were obtained for the annoyance to four groups of stimuli, designated as (1) pairs, (2) specials, (3) unscheduled traffic, and (4) loudspeaker noise. Author

N70-13915*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA ACOUSTICALLY TREATED NACELLE PROGRAM RESULTS
Robert W. Boswinkle, Jr. *In its* NASA Acoustically Treated Nacelle Program 1969 p 155–157 (See N70-13901 03-02)
Avail: CFSTI CSCL 01C

Important results of the NASA Acoustically Treated Nacelle Program are illustrated. The noise reduction with nacelle treatment during landing approach is shown as a function of percent change in direct operating cost (DOC). The coordinates for the McDonnell Douglas design are 10.5 EPNdB at a 4.2 percent DOC increase, and for the Boeing design 15.5 EPNdB at a 9.2 percent DOC increase. These direct operating cost increases are largely due to the costs of retrofitting the airplanes considered and are not applicable to other situations where treatment may be incorporated during original production. The results show: (1) substantial noise reductions are possible, and (2) the direct operating costs increase with increasing noise reductions. Author

N70-13946# National Research Council of Canada, Ottawa (Ontario).
DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Bulletin, 1 Apr. – 30 Jun. 1969
30 Jun. 1969 96 p refs
(DME/NAE-1969(2)) Avail: CFSTI

Flight tests of the SG 1262 hovering test rig are briefly discussed. One eight minute flight with the rig mounted on a pedestal, and two free flights of eight and ten minutes were completed. The test rig was designed to act as a tool to develop the control and stability characteristics for the VAK 191B, a VTOL reconnaissance and attack bomber, during low speed flight. Elevated temperature properties of cast and wrought Ni-base and Co-base superalloys were investigated with emphasis on high temperature strength and oxidation and sulphidation resistance of superalloys in coated and uncoated conditions. The X-ray line shape analysis for defect structure examination and X-ray line shift analysis for residual stress determination are described. These X-ray methods were used to develop high temperature protection coatings and for metal fatigue analysis. J.A.M.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-12728# Sandia Corp., Albuquerque, N. Mex. Aerospace Radioisotope Power Information Center.
APPLICABILITY OF HEAT PIPES TO ENERGY CONVERSION SYSTEMS
G. H. Whiting and K. T. Feldman, Jr. (N. Mex. Univ., Albuquerque) Jun. 1969 24 p refs Sponsored by AEC Supersedes SC-DC-67-2003
(SC-ARPIC-1012; SC-DC-67-2003) Avail: CFSTI

The heat pipe is a unique, high flux, heat transport device which utilizes the evaporation, condensation, and surface tension of a working fluid to give it an effective thermal conductivity several thousand times that of copper. The major operating characteristics of a heat pipe are nearly perfect isothermal operation over lengths of several feet, thermal transformer operation where heat is added over a small area at high flux and removed over a large area at a low flux and vice versa, thermal power flattening where large variation in output heat flux cause very little variation in output heat flux. The heat pipe is ideally suited for energy supply, removal, and thermal control of energy conversion systems. Performance characteristics and possible applications to conventional and direct energy conversion systems for terrestrial and space use are discussed. Author (NSA)

N70-13019# Australian Atomic Energy Commission, Coogee.
SAFETY ASPECTS OF LAUNCHING SATELLITE VEHICLES CARRYING RADIOISOTOPIC POWER GENERATOR
1969 44 p refs
(NP-17939) Avail: AEC Depository Libraries

General safety aspects of possible applications of radioisotopic power generators in ELDO launch vehicles Europa 1 and 2 in the 1970's are discussed. Missions would require 5 to 500 W for 1 to 5 years, to power electrical equipment in unmanned satellites. Fuels considered are Sr-90, Pu-238, and Ac-227. Principles of radioisotopic generators are discussed briefly. Hazards considered are those arising in transport, storage, loading, launch, orbit, and re-entry phases. Special mention is made of recovery of isotopic fuel after the flight phase. Safe launching of ELDO vehicles with radioisotopic generators is feasible; additional restrictions required are not prohibitive. The recommendations, including that of a capsule design for intact re-entry survival, should be considered at the system design stage. Detailed consideration of re-entry from a delaying orbit was not made. NSA

N70-13242# Army Electronics Command, Fort Monmouth, N.J.
MECHANICALLY RECHARGEABLE ZINC-AIR BATTERY Technical Report
David Linden Aug. 1969 14 p refs
(AD-693865; ECOM-3159) Avail: CFSTI (AD-693865; ECOM-3159) Avail: CFSTI CSCL 10/3

The mechanically rechargeable zinc-air battery is a new power source that has an energy density in the order of 100 watthours per pound, twice that of the closest competing battery system. The many advantageous characteristics of this battery have encouraged its use with portable military equipment in communications, surveillance and other forward area uses. The characteristics and electrical performance of this new battery are discussed and its advantages over other battery systems are illustrated. The applications of this battery in communication, surveillance and other forward area military applications also are described. Author (TAB)

N70-13251# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INTEGRAL CHARACTERISTICS OF AN MHD GENERATOR WITH DIVERGING ELECTRODES
I. V. Lavrentev 12 Mar. 1969 15 p refs Transl. into ENGLISH from Elektrofizicheskaya Apparatura (USSR), no. 6, 1967 p 83–93
(AD-694396; FTD-HT-23-1508-68) Avail: CFSTI CSCL 10/2

Edge effects in and integral characteristics of MHD-generators with a constant-cross-section channel and with finite-length electrodes were investigated. The article considers a MHD-generator whose working channel has radially diverging electrodes: both pressure and speed undergo drawdown. Formulas for the potential difference across the electrodes, usable power, Joules loss in the channel, and electrical efficiency are derived. Author (TAB)

N70-13348# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMOELECTRIC POWER SUPPLIES
E. K. Iordanishvili Mar. 1969 199 p refs Transl. into ENGLISH from the Russian
(AD-690786; FTD-MT-24-53-69) Avail: CFSTI CSCL 10/2

The monograph examines the contemporary state of the problem of research and development of the most effective thermoelectric materials and methods of commutation, methods of design and investigation of semiconductor thermoelements, and also materials related to the development and use of domestic and foreign thermoelectric units, hydrometeorological, ground and space assignments. A special place is dedicated to a consideration of different aspects of the design, creation and application of cascade thermoelements, which at present play an important role in methods of thermoelectric generation of electric power. Inclusion of chapters expounding thermodynamic theory of thermoelectric generators and thermoelectric phenomena gives scientists and engineers a sufficiently full account of the whole contemporary state of this area of science and technology. The concluding part of the monograph examined prospects of the application of thermoelectric units of different designations and their possible combination with units which use other methods of direct conversion of thermal energy into electrical. A thematic bibliography complete up to 1967 embraces basic domestic works in the area of thermoelectric materials, thermoelements and thermoelectric units. TAB

N70-13479*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF A GAS-SOLID SUSPENSION WORKING FLUID ON RADIATOR CHARACTERISTICS FOR A 1-MEGAWATT BRAYTON SPACE POWER CYCLE
Robert Pfeffer, Salvatore Rossetti, and Seymour Lieblein Washington Dec. 1969 31 p refs
(NASA-TM-X-1933) Avail: CFSTI CSCL 10B

Radiator heat-transfer and geometric characteristics were calculated for a high-temperature 1-megawatt single-loop Brayton space power cycle containing inert-gas graphite-suspension working fluids. For optimum conditions, particle radiation had a relatively small effect on overall heat transfer, and resulted in only a 2 to 3 percent reduction in minimum radiator planform area. Maximum reduction in minimum planform area with a suspension varied from 9 percent for argon to 13 percent for helium. Author

N70-13498*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF VOLT-AMPERE LOADING AND OUTPUT DISTORTION FOR A TURBOALTERNATOR WITH MULTIPLE LOAD PHASE-CONTROLLED PARASITIC SPEED CONTROLLER
Dennis A. Parz and Martin E. Valgora Washington Dec. 1969 35 p refs
(NASA-TN-D-5603; E-5136) Avail: CFSTI CSCL 10B

The reduction of alternator volt-ampere loading and output distortion by means of multiple phase-controlled parasitic loads is evaluated. Experimental data are compared with an analysis made previously. Results show that test circuit reactances greatly reduce the expected level of current distortion. Current distortion is significantly reduced by using two parasitic loads instead of one but little further reduction occurs for three loads. This results from design limitations in the parasitic load phase control circuitry. Experimental data for volt-ampere loading agrees well with predictions. Author

N70-13527*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
RESEARCH, DEVELOPMENT AND FABRICATION OF LITHIUM SOLAR CELLS Quarterly Report
Peter A. Iles 15 Oct. 1969 12 p Prepared for JPL
(Contracts NAS7-100; JPL-952546)
(NASA-CR-107266; QR-1) Avail: CFSTI CSCL 10B

In this quarter, most attention was concentrated on various acceptor sources, and the interaction of these sources with subsequent lithium solar cell properties. It appears possible now to obtain increased output from oxygen-poor silicon, and to provide cells with a gradual transition from earlier cells which used standard BCl3 processes. The shipments scheduled and much of the work for the next period will continue the emphasis of the present period. Author

N70-13548# Gulton Industries, Inc., Metuchen, N.J. Research and Development Div.
ACCEPTANCE TESTING OF VENTED, RECHARGEABLE SILVER-CADMIUM CELLS Final Report, Sept. 1968–Jan. 1969
S. Charlip and H. N. Seiger Aug. 1969 37 p
(Contract DA-36-039-AMC-03359(E))
(AD-693845; ECOM-03359-F) Avail: CFSTI CSCL 10/3

The objectives of the work discussed in this report were to test vented silver-cadmium cells, in four sizes with a common base area to the requirements of Electronics Command Technical Requirement SCL-7722A. The report gives the capacities obtained from acceptance testing under the following conditions: room temperature capacity and seven day storage; cold temperature (-40F); and high temperature (+160F) seven day storage. Author (TAB)

N70-13671# Office National d'Etudes et de Recherches Aérospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
DEGRADATION OF SOLAR CELLS IRRADIATED BY ELECTRONS AND PROTONS [DEGRADATION DES CELLULES SOLAIRES SOUS IRRADIATIONS D'ELECTRONS ET DE PROTONS]
J. Bernard and J. P. Buisson Aug. 1969 152 p refs In FRENCH; ENGLISH summary
(ONERA-NT-02-11) Avail: CFSTI

Characteristics of devices using semiconductors as a basic material change under the action of ionizing particles which are present in the radiation belt. In this work, the effects on silicon solar cells are analyzed. The electric and photovoltaic properties are studied as function of two parameters, the energy and integrated fluxes of protons and electrons. The damage coefficients are determined by measurement of the diffusion length of minority carriers, this measurement is obtained by photovoltaic and electrovoltaic methods. In order to study the action of different components, cells with and without filters and the filters themselves are irradiated. Author (ESRO)

N70-13679# Gulton Industries, Inc., Metuchen, N.J. Research and Development Div.
CYCLE LIFE TESTING OF SEALED, RECHARGEABLE SILVER-CADMIUM CELLS Final Report, Sep. 1968–Jun. 1969
S. Charlip and H. N. Seiger Fort Monmouth, N.J. ECOM Sep. 1969 25 p
(Contract DA-36-039-AMC-03358(E))
(AD-693844; ECOM-03358-F) Avail: CFSTI CSCL 10/3

Reported are the cycle life tests of sealed, silver-cadmium cells. The report gives the cell capacities for each of the 112th manual discharge cycles following 110 successive automatic and one manual cycle at 62-1/2 % depth of discharge based on rated capacity. The automatic cycling regime consisted of a 6 hour orbit, 3-1/2 hours of charging and 2-1/2 hours of discharge. The report gives data on cell capacities for a total of 1008 cycles. Author (TAB)

N70-13812# Union Carbide Corp., Parma, Ohio. Fuel Cell Dept.
SIMPLIFIED HYDRAZINE-AIR FUEL CELL Final Report, 4 Nov. 1968–4 May 1969
M. B. Clark and K. V. Kordesch Sep. 1969 49 p refs
(Contract DAAB07-69-C-0083)
(AD-693846; ECOM-0083-F; FR-2) Avail: CFSTI CSCL 10/2

Discussed is the development of a hydrazine-air fuel cell which will operate on high fuel concentrations, without circulating electrolyte. The fuel cell cathodes do not contain noble metal catalysts. A membrane was selected which could be applied directly to the surface of the electrodes, and had a low resistance. A dual-porosity anode and a reversed-type cathode were used. The cell configuration consisted of two anodes and two cathodes. Hydrazine monohydrate was injected into the electrolyte space between the anodes, and its diffusion to the active cathode sites was restricted by four barriers: the dense porous structure of the anode; the anode membrane; the cathode membrane, and the porous nickel support of the reversed-cathode structure. The cell construction method chosen was based upon a pair of injection-molded side pieces to which the electrodes were cemented. These side rails defined the cell thickness. Special features of the cells consisted of the hydrazine-injection manifold arrangement, baffles in the cell reservoir to prevent spillage, and silver strips connecting the anodes and the cathodes to small contact pins located in the cell cap. Environmental testing of cells was limited because of insufficient time, but did include the study of: (a) current-voltage characteristics and internal cell resistance; (b) temperature dependence; (c) air-flow dependence; (d) water balance; (e) cell life, and ( ) hydrazine efficiency. Author (TAB)

N70-13983# Sandia Corp., Albuquerque, N.Mex. Aerospace Nuclear Safety Dept.
IMPACT TESTS OF HEAT SOURCE FOR EARLY APOLLO SEISMIC EXPERIMENT PACKAGE
W. J. Dalby Jun. 1969 62 p refs
(SC-DR-69-326) Avail: CFSTI

Twenty-six impact tests of the heat source for the Early Apollo Seismic Experiment Package (EASEP) were completed. These tests were conducted to permit the selection of an acceptable configuration and to evaluate the adequacy of the design selected. The results of the series 2 impact tests indicate that the heat source may reasonably be expected to contain the fuel after impact under the postulated accident conditions. Author (NSA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-12811# California Univ., San Francisco. Lab. of Radiobiology.
ON THE GENETIC EFFECTS OF IONIZING RADIATION
Sheldon Wolff [1969] 20 p refs Presented at 2nd Congr. of the Natl. Acad. of Mexico, Jan. 1969 Sponsored by AEC
(UCSF-10P2-71; Conf-690118-1) Avail: CFSTI

Data accumulated by various workers on the genetic effects of radiations on the fitness of animal populations are summarized. Emphasis is placed on criteria that help to distinguish between radioinduced chromosomal aberrations and point mutations. The difficulties of estimating the genetic hazards of radiations to human populations from the mutation rates calculated for animals are discussed. NSA

N70-12827# Brookhaven National Lab., Upton, N.Y.
RESPONSES IN MUTATION, GROWTH INHIBITION, TUMORIZATION, AND ISOZYME MULTIPLICITY FROM EXPOSING SEEDS TO IRRADIATION OF DIFFERENT LINEAR ENERGY TRANSFER
H. H. Smith, Y. Hirono, M. E. Conklin, and J. T. Lyman 1969 28 p Presented at the Symp. on the Nature, Induction, and Util. of Mutation in Plants, Pullman, Wash. Prepared in Cooperation with Adelphi Univ. and California Univ.
(BNL-13763; Conf-690703-6; SM-121/35) Avail: CFSTI

Seeds of a genetic stock of Arabidopsis thaliana and of three genotypes of Nicotiana were irradiated. The irradiations ranged in linear energy transfer (LET) from 2 keV/micron (250 kVp X-rays) to 1890 keV/micron (argon ions). The responses measured were somatic mutations, tumorization, various manifestations of growth inhibition, and the production of peroxidase isozymes. The relative biological effectiveness (RBE) for all criteria measured, including mutations, was highest at LET's of 74 to 172 keV/micron. This indicated a common primary target, the genetic material, for each effect. The RBE is inversely related to absorbed dose so that genotypes or criteria that are affected by low doses give relatively high RBE's and vice versa. The production of multiple forms (isozymes) of peroxidases is enhanced by irradiation, is dose dependent, is relatively more affected per unit dose by neutrons than by X-rays, and provides a readily measurable response to irradiation at a molecular level. Author (NSA)

N70-12885# Blume (John A.) and Associates Research Div., San Francisco, Calif.
MOTION PERCEPTION IN THE LOW-FREQUENCY RANGE
Jul. 1969 53 p refs
(Contract AT(26-1)-99)
(JAB-99-47) Avail: CFSTI

The results of human threshold of motion perception tests in the 1 to 5 sec period range are presented. Parameters which affect motion perception are the individual test subject, the period of motion, and the configuration of the test subject. Previous investigations had not included motion in frequencies above 1.0 sec. Because the natural fundamental mode periods of tall buildings and other large structures are usually longer than 1.0 sec, it is important to identify perception thresholds in the period range. Test results at and above 1 sec periods were compared with results of other investigations of threshold of human perception. The threshold of perception (in terms of acceleration) increases with frequency of motion, but approaches a constant value of 0.002g at long periods (>1.0 sec). Acceleration was found to be the best parameter for motion perception. Author (NSA)

N70-12980# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
THE NEED FOR FOREST INVENTORIES
Donald A. Stellingwerf 16 Oct. 1969 19 p refs
Avail: CFSTI

The needs and uses of inventories, and methods of taking them are discussed. The benefits of controlled forests for the balance of nature and for industrial purposes are described, along with the trends of deforestration in developing countries and reforestration in developed countries. Methods of obtaining inventories are traced from Medieval times to the present statistical, and aerial and satellite photographic and photogrammetric techniques. It is pointed out that aerial photography is very useful for heterogeneous forests, but its use is restricted for homogeneous forests. Predicting wood needs, conservation activities, and forest fire fighting are also considered. N.E.N.

N70-12985*# University of Southern Calif., Los Angeles. Dept. of Physiology.
DEPARTMENT OF PHYSIOLOGY Progress Report, 10 Jul. – 9 Oct. 1969
24 Nov. 1969 13 p ref
(Grant NSR-05-018-087)
(NASA-CR-107187) Avail: CFSTI CSCL 06P

During this reporting period the major efforts were concentrated toward developing an implantable cardiac sonomicrometer. Circuitry was designed and tested, several crystal probes were fabricated and the device was calibrated and tested by an acute measurement of dynamic atrial and vena cava dimensions in an experimental animal. Author

N70-12986# Japan Atomic Energy Research Inst., Tokai. Div. of Health Physics and Safety.
REMOVAL OF DEPOSITED PLUTONIUM FROM BODY BY CHELATING AGENTS: REVIEW
Junko Iwamoto and Minoru Fujita Sep. 1969 36 p refs In JAPANESE; ENGLISH summary
(JAERI-4048) Avail: CFSTI

For the purpose of removing plutonium from man, it is known that chelating agents, especially DTPA, are useful. However, the method of administration is not fully established and the effectiveness of the chemicals also is not clear. Therefore, this report attempts to survey the literature published from 1955 to 1968 and to summarize the present knowledge of the chelating agents which are being used for removal of plutonium. Author

N70-12988# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
BIOLOGY AND HEALTH PHYSICS DIVISION Progress Report, 1 Apr. – 30 Jun. 1969
30 Jun. 1969 47 p
(AECL-3430; PR-B-82) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.50

A method for making fission fragment tracks visible to the eye is described. Etched film which has been irradiated is placed as an insulator between a plane high-voltage electrode and a grounded thin layer of aluminum. When voltage is applied sparks pass through the holes in the film and evaporate holes in the aluminum layer. At the conclusion of the discharge a pattern of holes in the aluminum provides a replica of the film pattern, with holes large enough to be seen by eye. Also included are reports in: biochemistry and molecular biology, environmental research, and health physics. F.O.S.

N70-13009# California Univ., Davis. Radiobiology Lab.
FALLOUT Cs-137 ACCUMULATION IN TWO SUBPOPULATIONS OF BLACK-TAILED DEER (ODOCOILEUS HEMIONUS COLUMBIANUS)
Steven Arnold Book (M.S. Thesis) Jun. 1969 61 p refs
(Contract AT(11-1)-34)
(UCD-34-P-104-14) Avail: CFSTI

Results are reported from an investigation of various parameters influencing the uptake of fallout Cs-137 in a wild population of Columbian black-tailed deer (Odocoileus hemionus columbianus) at the Hopland Field Station of the University of California. The variation in Cs-137 body burdens of deer living in relatively close proximity yet occupying different elevational habitats was studied in relation to rainfall, type and availability of forage species, foliar contamination by the radionuclide, and dietary preferences. Author (NSA)

N70-13015# Boeing Co., Wichita, Kans.
TEN YEARS OF HUMAN VIBRATION RESEARCH
J. E. Beaupeurt, F. W. Snyder, S. H. Brumaghim, and R. K. Knapp
Aug. 1969 66 p refs
(Contract NONR-2994(00))
(AD-693199; D3-7888) Avail: CFSTI CSCL 6/19

The vibration research was organized around three main interest areas, (1) subjective reaction to vibration, (2) effects of vibration on sensory and motor processes, and (3) physical effects of vibration. The report briefly highlights these main interest areas, introducing methodological aspects, mentioning general results, and suggesting how the various aspects of the program fit together. TAB

N70-13174# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biological Acoustics Branch.
HUMAN AUDITORY RESPONSE TO AN AIR BAG INFLATION NOISE Research Report, Dec. 1968–Mar. 1969
Charles W. Nixon 7 Mar. 1969 43 p refs
(Contract PO-9-1-1151)
(PB-184837; HS-800-153) Avail: CFSTI CSCL 06S

An investigation was undertaken for the purpose of confirmation or denial of the interpretation that the system noise exposure caused by air-bag inflation does not constitute an acoustic hazard. The investigation considered various auditory responses including eardrum membrane response, temporary threshold shift (TTS), persistent TTS, inability to communicate verbally or perceive other acoustic signals due to TTS immediately following exposures and aural discomfort or pain. USGRDR

N70-13210# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 3, NO. 4
24 Nov. 1969 142 p refs Transl. into ENGLISH from Kosmich. Biol. i Med. (Moscow), v. 3, no. 4, 1969 p 3–91
(JPRS-49297) Avail: CFSTI

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11. EXPERIMENTAL STUDY OF THE DIURNAL PERIODICITY IN PHYSIOLOGICAL FUNCTIONS AND HUMAN PERFORMANCE DURING DISRUPTION OF SLEEP AND WAKEFULNESS PATTERNS A. N. Litsov p 85–96 refs (See N70-13221 03-04)

12. CHANGE IN BONE SYSTEM TOLERANCE TO ACCELERATIONS AFTER PROLONGED WEIGHTLESSNESS S. A. Gozulov et al p 97–103 refs (See N70-13222 03-04)

13. EXCRETION AND BALANCE OF CERTAIN ELEMENTS DURING PROLONGED USE OF DEHYDRATED FOODS Y. I. Pokrovskaya et al p 104–111 refs (See N70-13223 03-04)

14. A CONTACTLESS METHOD FOR REGISTERING INDICES OF THE CARDIOVASCULAR AND RESPIRATORY SYSTEMS R. M. Bayevskiy et al p 112–115 refs (See N70-13224 03-04)

15. EXPERIMENT IN USING METHODS OF MATHEMATICAL PLANNING FOR STUDYING THE PROCESS OF BIOLOGICAL MINERALIZATION I. M. Chirkov et al p 116–120 refs (See N70-13225 03-04)

16. THE PHYTOTRON IN STOCKHOLM V. P. Dadykin et al p 121–123 (See N70-13226 03-04)

17. REFLEX REACTIONS AND CONDITION OF SOME AUTONOMIC FUNCTIONS OF WHITE RATE SUBJECTED TO HYPOTHERMIA G. V. Altukhov et al p 124–126 (See N70-13227 03-04)

18. INCREASED BODY TOLERANCE TO HYPOXIA FROM ACID INJECTIONS A. Kh. Kogan et al p 127–128 (See N70-13228 03-04)

N70-13211# Joint Publications Research Service, Washington, D.C.
SOME RESULTS OF STUDY OF THE NATURE OF BODY TOLERANCE AND MECHANISMS OF ITS CHANGE
Z. I. Barbashova *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 8–14 refs (See N70-13210 03-04)
Avail: CFSTI

Studied was the nature of body tolerance and the mechanism of its change at tissue, cellular, an subcellular levels in animals by experimentally changing their resistance to hypoxia. Month long adaptation to hypoxia and to muscular work was reduced by the effects of an adrenalectomy, a direct correlation between body tolerance, the tolerance of its tissues and the characteristics of the course of biochemical processes in them was proven. During

early adaptation, some animals showed a glycolysis stimulation in cerebral tissues. Best adaptation times to hypoxia for the various tissues was between 20 to 30 days. G.G.

N70-13212# Joint Publications Research Service, Washington, D.C.

RESPIRATION AND MINERAL NUTRITION OF HYPOTHETICAL MARTIAN ORGANISMS AND OTHER PROBLEMS IN MARTIAN BIOLOGY

K. A. Lyubarskiy *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 15-21 refs (See N70-13210 03-04)
Avail: CFSTI

Listed are the basic characteristics for a model of Martian organisms: (1) organisms are photosynthesizing; (2) pigment sensitizing photosynthesis has the main absorption band in the blue part of the spectrum; (3) organism epithelium contains hydrochrome pigments able to mask the fundamental color; (4) organisms are dense encrustations with unbroken surfaces; (5) biocolloid contents are small; (6) cell fluids contain large amounts of soluble substances; (7) moisture absorption occurs by epiphytic means or hoarfrost assimilation; (8) transpiration does not occur; (9) trivalent iron compounds are used as respiratory substrates; (10) mineral salts serve as nutrition; (11) pH content of cell juices is low; and (12) the external epidermic layers acquire coarser cellular structures during the spring-summer season. G.G.

N70-13213# Joint Publications Research Service, Washington, D.C.

EFFECT OF DEHYDRATED FOODS ON THE FUNCTIONAL STATE OF THE HUMAN BODY

V. P. Bychkov *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 22-31 refs (See N70-13210 03-04)
Avail: CFSTI

The possibility of long term use of dehydrated foods and of the effects of this ration on the metabolism of the human body was studied by feeding human volunteers in a six month experiment 3,100 Cal of dehydrated foods. Investigated diets differed somewhat in caloric content, chemical composition, and methods of preparation. Subjects remained healthy and maintained their initial performance over the entire length of experimentation. However, some change in protein metabolism was noted: nitrogen balance levels decreased as did amino acids in the blood serum together with a change in the ratio of protein fractions. G.G.

N70-13214# Joint Publications Research Service, Washington, D.C.

PROBLEMS IN RADIATION SAFETY DURING MANNED FLIGHTS IN 'SOYUZ' SPACESHIPS

Ye. I. Vorobyev et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 32-39 refs (See N70-13210 03-04)
Avail: CFSTI

This paper presents the basic principles for maintaining radiation safety of manned "Soyuz-3, 4 and 5" flights. During all the missions radiation levels in the space cabin and along the spaceship trajectory remained within the admissible limits, as indicated by on-board measurements and observations of geophysical effects. Analysis of the findings indicates that radiation safety was maintained during these three manned flights. Author

N70-13215# Joint Publications Research Service, Washington, D.C.

COMPUTING THE JUSTIFIED RISK DOSE DURING PROLONGED SPACE FLIGHTS

Ye. Ye. Kovalev et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 40-44 refs (See N70-13210 03-04)
Avail: CFSTI

This paper presents a procedure for calculating justified risk doses during chronic irradiation, depending on the exposure time. Processes of radiation repair in a living organism are described by means of a Blair model. Using the above procedure and adopted justified risk doses for flights of short duration, adequate levels for long-duration missions are evaluated. Author

N70-13216# Joint Publications Research Service, Washington, D.C.

HEMOPOIETIC CHANGES IN DOGS DURING PROLONGED FRACTIONAL IRRADIATION

M. F. Sbitneva et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 45-50 refs (See N70-13210 03-04)
Avail: CFSTI

Experiments on dogs were carried out to study the hemopoietic effects of prolonged fractional gamma irradiation (repeated four times with a dose of 50 R/day once a week) The exposure caused a short-term decrease in the leukocyte and thrombocyte content and a reduction in neutrophil phagocytic activity in the peripheral blood and a decrease in the number of megakaryocytes in bone marrow punctates. Tests with sodium nucleinate revealed that leukopoiesis activity remained sufficiently high. Author

N70-13217# Joint Publication Research Service, Washington, D.C.

SIGNIFICANCE OF IMMUNOBIOLOGICAL INDICES IN DETECTION OF RADIATION DAMAGE

G. M. Lvitsyna et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 51-56 refs (See N70-13210 03-04)
Avail: CFSTI

Immunobiological reactivity of dogs was studied during their single exposure to 126-MeV protons in doses of 55, 89 and 160 rads. Reflecting fine changes in the total reactivity of the living body, immunological tests indicated its high sensitivity even to nonlethal radiation doses. A correlation was established between changes in natural immunity factors and the magnitude of the absorbed energy and degree of shift in other biological indices. A short-term decrease of bactericidal properties of the skin and the absolute phagocytic index was found during a proton irradiation even with a dose of 55 rads. Earlier and more significant changes in immunobiological indices were detected as the dose was increased. Author

N70-13218# Joint Publications Research Service, Washington, D.C.

BIOLOGICAL EFFECT OF 50-MeV PROTONS ON INTESTINAL EPITHELIUM CELLS IN MICE

V. M. Mastryukova et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 57-63 refs (See N70-13210 03-04)
Avail: CFSTI

This paper presents the results of a study of the mitotic activity, number of chromosomal aberrations and number of cells in sections of crypts and villi of the intestinal epithelium of mice exposed to a total irradiation with 50-MeV protons in doses of 250, 500 and 750 rad. These indices revealed substantial shifts but they were reversed during a nine-day observation period. Author

N70-13219# Joint Publications Research Service, Washington, D.C.

MEDICAL STUDIES MADE DURING FLIGHTS OF 'SOYUZ-3,' 'SOYUZ-4' AND 'SOYUZ-5' SPACE SHIPS

Ye. I. Vorobyev et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 64-76 (See N70-13210 03-04)
Avail: CFSTI

This paper summarizes the preliminary results of medical observations made during the manned "Soyuz-3," "Soyuz-4" and "Soyuz-5" space flights. Changes in physiological reactions of cosmonauts when within space cabins were similar to those observed during previous flights. Medical data recorded during the

emergence of cosmonauts from the spacecraft are described. Analysis of the collected data suggests that spacecrew members had no pathological changes throughout the entire mission. The observed physiological changes are regarded as adequate responses to exposure to spaceflight factors. Author

N70-13220# Joint Publications Research Service, Washington, D.C.

EXPERIMENTAL APPROACHES IN STUDYING THE EFFECTIVENESS OF LOCAL BODY SHIELDING FOR COSMONAUTS

G. M. Abramova *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 77-84 refs (See N70-13210 03-04)

Avail: CFSTI

An experimental method has been developed for making radiobiological studies of the effectiveness of local body shielding from ionizing radiation from beams of high-energy protons. In all the experiments carried out on dogs a shielding was placed on parts of the body equal to their weight. The restrained animals were exposed to irradiation for 10-15 minutes. The dose gradient did not exceed + or- 10%. The local body shielding provided a tenfold decrease of the dose effect in the shielded part of the animal body. Author

N70-13221# Joint Publications Research Service, Washington, D.C.

EXPERIMENTAL STUDY OF THE DIURNAL PERIODICITY IN PHYSIOLOGICAL FUNCTIONS AND HUMAN PERFORMANCE DURING DISRUPTION OF SLEEP AND WAKEFULNESS PATTERNS

A. N. Litsov *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 85-96 refs (See N70-13210 03-04)

Avail: CFSTI

A drastic alteration of work and rest cycles caused a gradual restructuring of physiological functions and the performance pattern of six healthy pilots used as test subjects. The restructuring included three stages: latent, apparent and deep. The rate with which different functions of the human body adjusted to a new environment varied: the EEG and simple motor reactions changed with the highest rate whereas autonomic functions and highly coordinated mental activity changed with the lowest rate. The restructuring of diurnal periodicity under experimental conditions was considerably affected by the pattern of physical and mental activity and the sleep of the test subjects and their motivation. The dynamics of restructuring of physiological functions, performance and sleep of human beings should be considered as the best indication of human adaptation to an altered pattern of their activity. Author

N70-13222# Joint Publications Research Service, Washington, D.C.

CHANGE IN BONE SYSTEM TOLERANCE TO ACCELERATIONS AFTER PROLONGED WEIGHTLESSNESS

S. A. Gozulov et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 97-103 refs (See N70-13210 03-04)

Avail: CFSTI

On the basis of data available in the literature, the authors, the skeletal strength in humans exposed to long-term weightlessness was determined. It was found that a mineral decrease in the vertebral column by 10% can reduce acceleration tolerance by 15%. It is suggested that a reduction of acceleration tolerance may be more pronounced following long-term space flights. Author

N70-13223# Joint Publications Research Service, Washington, D.C.

EXCRETION AND BALANCE OF CERTAIN ELEMENTS DURING PROLONGED USE OF DEHYDRATED FOODS

Ye. I. Pokrovskaya et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 104-111 refs (See N70-13210 03-04)

Avail: CFSTI

Six subjects consumed dehydrated diets during a 120-day experiment. During the experiment there were no significant changes in excretion and the balance of potassium, magnesium, phosphorus, sulfur or nitrogen. During the last two months an insignificant calcium balance was detected. The assimilation of sulfur decreased somewhat during the course of the experiment and that of calcium was substantially reduced in the second half of the experiment. Analytical studies of the mineral balance were made using mineralization of biological samples in an oxygen atmosphere on a platinum spiral, in a calorimetric bomb and in a quartz tube. Procedures were established for the application of the indicator nitchromazto to evaluate the sulfur content in the urine, feces and diets. A method was devised for determining magnesium and calcium in biological samples, using the atomic absorption analysis method. Author

N70-13224# Joint Publications Research Service, Washington, D.C.

A CONTACTLESS METHOD FOR REGISTERING INDICES OF THE CARDIOVASCULAR AND RESPIRATORY SYSTEMS

R. M. Bayevskiy et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 112-115 refs (See N70-13210 03-04)

Avail: CFSTI

A method of contactless registry of cardiovascular and respiration functions based on dielectrography has been developed. The new apparatus operates through changes in the dielectric constant of different parts of the body in response to rhythmic fluctuations with a frequency of 10 Mc/sec. This method makes it possible to register physiological data by means of electrodes built into garments, requiring no direct contact with the skin. Author

N70-13225# Joint Publications Research Service, Washington, D.C.

EXPERIMENT IN USING METHODS OF MATHEMATICAL PLANNING FOR STUDYING THE PROCESS OF BIOLOGICAL MINERALIZATION

I. M. Chirkov et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 116-120 refs (See N70-13210 03-04)

AVAIL: CFSTI

A mathematical method for planning a multifactor experiment has been used in studying the relationship between basic parameters of the process of biological mineralization of human wastes. An equation describing a nonlinear relationship between the substrate concentration and air consumption has been derived. It is shown that optimization of the process can be achieved using the described method. Author

N70-13226# Joint Publications Research Service, Washington, D.C.

THE PHYTOTRON IN STOCKHOLM

V. P. Dadykin et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 121-123 (See N70-13210 03-04)

Avail: CFSTI

Briefly reviewed are the technical aspects of a phytotron designed for plant cultivation under regulated environmental conditions. The apparatus contains two vegetation areas, dark rooms, artificial humidity and lightning regimes as well as temperature regulators. Outside air enters the system through multiple filters at a specified rate and circulates through . During a ten month period this apparatus operated reliably and satisfactorily. G.G.

N70-13227# Joint Publications Research Service, Washington, D.C.

REFLEX REACTIONS AND CONDITION OF SOME AUTONOMIC FUNCTIONS OF WHITE RATS SUBJECTED TO HYPOTHERMIA

G. V. Altukhov et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 124-126 (See N70-13210 03-04)

Avail: CFSTI

Described are changes in conditioned reflex activity and autonomic functions of white rats during cooling of their bodies to 30 degrees in the course of 2, 6, 10 and 24 hours. A definite stereotype of conditioned reflexes to sonic and visual stimuli was produced in the animals by a motor-food method and the latent period of the conditioned reflex was registered by electronic watch and voltmeters. It was shown that general body cooling to 30 degrees caused definite changes with a weakening in principal cortical processes, excitation, and inhibition. This was expressed in the total absence of conditioned reflexes, disappearance of reflexes to individual stimuli, or considerable lengthening of the latent period and disinhibition of differentiations. Impairments of conditioned reflex activities in the same animals were greater after the first cooling than during repeated ones. Multiple cooling of the animals to 30 degrees with different durations caused no irreversible changes six to eight months after experimentation. G.G.

N70-13228# Joint Publications Research Service, Washington, D.C.

INCREASED BODY TOLERANCE TO HYPOXIA FROM ACID INJECTIONS

A. Kh. Kogan et al *In its* Space Biol. and Med., Vol. 3, No. 4 24 Nov. 1969 p 127–128 (See N70-13210 03-04)
Avail: CFSTI

Investigated was the increased tolerance of mice to hypoxia after heavy work loads. Animals were injected subcutaneously with lactic or hydrochloric acid in the abdominal cavity prior to the onset of hypoxia during stepped atmospheric rarefaction down to 90 mm Hg. Both acids increased mice tolerance to hypoxia; however, the lactic acid was somewhat more effective. Experimental data showed that acid with a pH of 2.4 in doses of 0.4 ml per 10 grams body weight increased tolerance to hypoxia in mice. G.G.

N70-13284# Federation of American Societies for Experimental Biology, Bethesda, Md. Life Sciences Research Office.

A STUDY OF VISION AS RELATED TO DARK ADAPTATION AND NIGHT VISION IN THE SOLDIER

Aug. 1969 165 p refs
(Contract DAHC19-68-C-0001)
(AD-693292) Avail: CFSTI CSCL 6/16

The report was prepared to provide the Army Research Office with a summarization of recent advances in the understanding of dark adaptation and night vision capability. The scope of the study included: current knowledge of the biochemical and physiological aspects of dark adaptation and night vision, the role of nutrition as it affects dark adaptation, pharmacologically induced alterations of night vision, the effects of smoking and noxious environmental agents on night vision, and individual variability in dark adaptation and night vision capacity. Author (TAB)

N70-13447# Massachusetts Inst. of Tech., Cambridge.

HEALTH HAZARDS FROM ULTRASONIC ENERGY

Neil Goldstein and Anthony J. Sinzkey 28 Feb. 1969 214 p refs Prepared in cooperation with Northeastern Radiological Lab.
(PB-185963) Avail: CFSTI CSCL 06E

Ultrasound of therapeutic intensities can be hazardous even in the hands of the trained technician. A great deal of training is necessary for the proper use of ultrasound at these therapeutic levels. In cases where ultrasound emanates into air, the probability of damage to tissue is lower than in the case of direct contact since poor coupling is obtained between ultrasonic transducers and air. Equipment for the intentional use and production of ultrasound is widely available. Some of this equipment does not operate safely. The interactions of ultrasound in tissue have been studied. However, these interactions are amazingly complex. USGRDR

N70-13501# National Institutes of Health, Bethesda, Md. Translating Unit.

METHODOLOGIC TRIAL OF ANALYSIS OF THE SLEEP CYCLE

R. Tissot 4 Aug. 1969 31 p Transl. into ENGLISH from Encephale (French), 55:2, 1969 p 137–169
Avail: CFSTI

Mathematical analysis of the various stages of sleep indicates that paradoxic sleep is not a state as such, but is a function of that of the other classical stages. The accepted view of the antagonism of slow sleep in general and paradoxic sleep is questioned and a manifest antagonism is hypothesized between stages 3–4 and P; there is also probably a synergism of stages 2 and P. Based on the general equation of hyperbolas, equations are derived to calculate the curves of the sleep cycle and its variations under the influence of drugs. R.B.

N70-13526*# California Univ., San Diego.

SPACE RADIATION HAZARDS IN MAN Annual Report, 1 Oct. 1968–30 Sep. 1969

Norman A. Baily 30 Sep. 1969 19 p refs
(Grant NGR-05-009-103)
(NASA-CR-66871) Avail: CFSTI CSCL 06P

The research program being carried out can be classified in general as: (1) determination of the statistical distribution of the magnitudes of the energy losses by fast charged particles (protons) in tissue-like materials having biologically significant volumes; (2) radiobiological modeling; (3) experimental testing of the radiobiological models as to their capability for predicting radiation damage in human lymphocytes; and (4) development of an electronic system for recording, digitizing, and computer processing of biological indicators of radiation damage or other physiological changes incurred during space flight. All four phases have been given some effort during the past year with the bulk of the effort going into phase (a). Obtained were experimental data to assess the accuracy of available theoretical treatments for all energy losses having an occurrence probability of greater than 0.0001. Author

N70-13557# Florida Univ., Gainesville. Coll. of Medicine.

VISUAL CELLULAR STIMULATION BY HIGH-ENERGY QUANTA Technical Progress Report, 1 Dec. 1968–1 Sep. 1969

William W. Dawson 1 Sep. 1969 24 p refs
(Contract AT(40-1)-3599)
(ORO-3599-5) Avail: CFSTI

Techniques for localization of the retinal excitatory influence of ionizing radiation were further developed. It was demonstrated that in developing cat retinas where morphologically distinguishable receptors are not present, X-rays have approximately the same effect on signal production by visible light that they have in retinas where receptors are available for stimulation. The effectiveness of an inexpensive flash X-ray instrument for retinal stimulation was tested. Although dose rates (approximately 1 million R per second) were formidable, they were also misleading in that the actual doses available are in the milliroentgen range. This range is borderline for the production of usable retinal signals and should be considered threshold. Recommendations for suitable equipment for retinal stimulation are provided in the renewal request. New findings are reported on developing retinas with specific structural anomalies. Author (NSA)

N70-13568# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biological Acoustics Branch.

HUMAN AUDITORY RESPONSE TO AN AIR BAG INFLATION NOISE

Charles W. Nixon 7 Mar. 1969 33 p Sponsored in part by Natl. Highway Safety Bur.
(PB-184999) Avail: CFSTI CSCL 13L

Personal restraint systems employing the principle of rapidly expanding air bag (s) show promise of providing greater protection of occupants during motor vehicle impact than any other system or technique currently in use. This report describes the experimental program established and conducted to confirm or deny the judgment—' the restraint systems' acoustic impulse does not constitute a hazard to the auditory system of vehicle occupants'.
Author (USGRDR)

N70-13598# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
BIOMETRIC STUDY OF SWINE KARYOTYPE [ETUDE BIOMETRIQUE DU CARYOTYPE DU PORC]
Jean Haag, Nancy Lacourly, and Pierre Nizza Oct. 1969 21 p refs In FRENCH; ENGLISH summary
(CEA-R-3852) Avail: CFSTI

The purpose of this study is to determine the swine karyotype as accurately as possible and to try and develop a method of automatic classification and to show its possibilities and limits.
Author (ESRO)

N70-13620*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
VARIATION OF MAN'S PLASMA VOLUME DURING IMMERSION IN A THERMO-INERT WATER BATH [AENDERUNG DES PLASMAVOLUMENS DES MENSCHEN BEI IMMERSION IN EIN THERMOINDIFFERENTES WASSERBAD]
D. Kaiser et al Washington NASA Nov. 1969 9 p refs Transl. into ENGLISH from Arch. Ges. Physiol. (Berlin), v. 308, 1969 p 166–173
(Contract NASw-1692)
(NASA-TT-F-12422) Avail: CFSTI CSCL 06P

Urine flow, change in weight, plasma volume (Evan's Blue) and hematocrit were measured in 28 subjects before and after immersion up to the chin in a thermo-inert bath for 8 hours. A weight loss and a reduction in plasma volume occurred, although due to considerable scatter of the results no precise correlation between them was able to be established. Several other observations are discussed and tentatively explained.
Author

N70-13657# Sheffield Univ. (England). Dept. of Probability and Statistics.
CONTROL OF A PEST POPULATION Research Report
N. G. Becker May 1969 17 p ref
(RR-63INGB-4) Avail: CFSTI

The growth of a pest population in a habitat is taken to be according to a simple birth, death and immigration process and the control of this growth is considered over a finite time interval. Optimal continuous control of the birth and death rates subject to a control cost is considered as well as the optimal spacing of a constant control treatment applied at discrete time points.
Author

N70-13691# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
SEAT BELT INJURIES IN IMPACT
R. G. Snyder, W. M. Crosby, C. C. Snow, J. W. Young, and P. Hanson Mar. 1969 24 p refs
(AM-69-5) Avail: CFSTI

Although the seat belt was demonstrated to provide effective reduction of injuries and fatalities in automobile accidents by preventing ejection, a pattern of injuries directly attributable to impingement on the belt itself is becoming evident. This paper surveys the clinical evidence of restraint system injuries, discusses gross biomechanical mechanisms of trauma, and evaluates the potential of four principal types of restraint systems in producing injuries. New results are presented comparing the lap belt, diagonal, three-point, and double torso restraint systems in experimental primate impacts. The double shoulder harness (with lap belt) appears to offer the greatest protection of the systems compared, while the single diagonal belt (without lap belt) was demonstrated to be the most dangerous type in certain impact situations. A seat belt system properly installed and properly worn still offers the single best protection for the automotive occupant during an impact.
Author

N70-13751# Puerto Rico Nuclear Center, Rio Piedras.
POTENTIAL USE OF TARGET ATOM IRRADIATION IN CONTROL OF MUTATION INDUCTION
F. K. S. Koo [1969] 10 p refs Presented at Symp. on the Nature, Induction, and Util. of Mutations in Plants, Pullman, Wash.
(Contract AT(40-1)-1833)
(CONF-690703-2) Avail: CFSTI

Preliminary results are presented on a method for specific mutation induction. Seeds of Arabidopsis thaliana were irradiated with monochromatic X rays (mainly 14.10 and 14.16 keV) receiving a total dose of 5.1Rad. Some of the seeds had been previously labeled at timed intervals with 5-bromouracil deoxyriboside (BUDR) to provide a target atom which would be incorporated into specific genes depending on which state of DNA synthesis the treatment was applied. Seedling mutations were scored in the second generation and included changes in color and form of cotyledons and first leaves. The frequencies of 13 seedling mutant types induced by the BUDR and X-ray combination are reported for the different treatment periods. Specific types of mutants were not limited to particular treatment periods but were spread over several. It is concluded that further research is needed for evaluation of the method.
NSA

N70-13764# Bureau of Radiological Health, Rockville, Md.
BIOLOGICAL ASPECTS OF MICROWAVE RADIATION: A REVIEW OF HAZARDS
Wellington Moore, Jr. Jul. 1968 23 p refs
(PB-185964; TSB-68-4) Avail: CFSTI CSCL 06R

The report describes the principal uses of microwaves and presents information from a literature review pertaining to the nature of biological effects. The conclusions of a relatively large number of experiments and observations concerning biological effects are discussed.
USGRDR

N70-13770# Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. für Flugmedizin.
THERAPY AND REGENERATION OF IMPACT LESIONS IN ANIMAL EXPERIMENTS [THERAPIE UND REGENERATION VON DRUCKSTOSSVERLETZUNGEN IM TIERVERSUCH]
Otto Wünsche and Gerhard Scheele Sep. 1969 37 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-56) Avail: CFSTI

The general pathogenesis of shock wave injuries as well as the lesions seen in animals are described and the results of therapeutic measurements in shock wave injured guinea-pigs discussed. High pressure was applied therapeutically to overcome coronary and cerebral air embolism and increase the oxygenation of blood and tissue at the same time. Acute edema in the pulmonary alveoli and the peribronchium were treated with the 'Lasix' diuretic. The cardiovascular system which was particularly submitted to stress following lung injuries was supported by application of analeptica. Tranquillizers were used to sedate the animals. The results of the therapeutic measures were controlled by histological investigations of the tissue regeneration in the injured organs over a period of 60 days.
Author (ESRO)

N70-13836# Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
MECHANISMS OF WINDBREAK INFLUENCE ON MICROCLIMATE EVAPOTRANSPIRATION, AND PHOTOSYNTHESIS OF THE SHELTERED CROP Final Report
Kirk W. Brown and Normal J. Rosenberg May 1969 259 p refs
(Grant Cwb-WBG-54)
(PB-184789; PR-71) Avail: CFSTI CSCL 13M

It has been demonstrated that the use of a well designed windbreak often favorably influences crop productivity and water use efficiency. Although many studies of the influence of windbreaks on the microclimate have been made, only a few researchers have speculated on and even fewer have given evidence for the mechanism or mechanisms by which the windbreak is influential. These studies have generally been made in large uniform fields. Windbreaks interfere with the natural patterns of air flow over a field, thus creating a situation which is analytically not ideal. The microclimate of a field crop is a result of both the large scale meteorological phenomena and the characteristics of the crop surface. Author (USGRDR)

N70-13857# Naval Training Device Center, Orlando, Fla. Human Factors Lab.
EYE MOVEMENT RESEARCH PROGRAM Annual Report, Jan. – Dec. 1968
Stephen Jordan Jul. 1969 34 p refs
(AD-694465; NAVTRADEVCEN-IH-168) Avail: CFSTI CSCL 6/16

The first section of the report reviews the literature on technique and experimentation in eye movement research as it affects training device development. In the second section the current program of the Human Factors Laboratory is described. This includes the preliminary experimentation on visual guidance techniques and the refinement of the electro-oculographic method of recording eye position. Author (TAB)

N70-13960# Argonne National Lab., Ill.
THE EFFECT OF CATALASE AND CERTAIN OTHER FACTORS ON INDUCED REDUCTION AND THE ROLE OF HYDROGEN PEROXIDE OF ENZYMATIC ORIGIN IN THIS REACTION [O DEISTVII KATALAZY I NEKOTORYKH DRUGIKH FAKTOROV NA INDUTSIROVANNUYU REAKTSIYU A VOSSTANOVLENIYA I UCHASTIE NEI PEREKISI VODORUDA FERMENTATIVNOGO PROSKHOZHDENIYA]
A. A. Gurevich and T. V. Khripach Sep. 1969 8 p refs Transl. into ENGLISH from Conf. Presented at Uppavlyaemyi Biosintez; Dokl. Na Konf. Po Upravlyaemomu Biosintezu I Biofizike Populyatsii, (Krasnoyarsk), 26 Jun. – 6 Jul. 1965
(PB-186067T; AN-TRANS-772) Avail: CFSTI CSCL 06A

Experiments were conducted which make it possible to establish the inhibition of induced hydrogen transfer under the influence of catalase in the presence of hydrogen peroxide. Most likely catalase with the assistance of hydrogen peroxide oxidizes the active free radicals of ascorbic acid (formed in its monovalent oxidation under the action of the peroxidase enzyme) to dehydroascorbic acid which no longer exhibits reducing properties. It seems evident from the research that a number of factors in a biological medium are of influence, having a possible regulatory effect on the course of induced hydrogen transfer in the aerobic organism. Catalase occupies an important place among these factors. Author (USGRDR)

N70-14054# Battelle-Northwest, Richland, Wash.
PACIFIC NORTHWEST LABORATORY. VOLUME 2: PHYSICAL SCIENCES. PART 3: INSTRUMENTATION Annual Report, 1968
N. S. Porter and W. G. Spear Jul. 1969 48 p ref
(Contract AT(45-1)-1830)
(BNWL-1051-Vol-2-Pt-3) Avail: CFSTI

Research activities during 1968 centered on the determination of radionuclide uptake in biological systems, physiological parametric data acquisition techniques, and the calibration of radiation measuring instruments. The suppression of background noise in solid state detectors by pulse shape discrimination is described. Cross correlation methods and an alpha scintillation detector system are advocated for monitoring radon in vivo. Silicon detectors are used for accurate measurements on radiation wound depths and a control system for in vivo neutron activation measurements is depicted. Included is also a program to define irradiation effects of cobalt 60 on avalanche diodes biased near breakdown. G.G.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-12762*# General American Transportation Corp., Niles, Ill. Research Div.
PERFORMANCE TESTS OF AN ORGANIC AMINE CARBON DIOXIDE REMOVAL SYSTEM Final Report
A. J. Glueckert and G. A. Remus Dec. 1969 85 p refs
(Contract NAS1-8360)
(NASA-CR-66847) Avail: CFSTI CSCL 06K

An experimental evaluation was conducted on a regenerable two-bed carbon dioxide removal system which utilized an organic amine sorbent. This sorber formulation absorbs CO2 in the presence of H2O vapor and thus does not require pre-drying the gas stream. The primary objective of the test program was to relate the system performance of CO2 removal rate, power, and water carry-over with CO2 during regeneration to the operating parameters of air flow rate through the bed, absorption-regeneration time, and bed cooling and heating rates. All other operating conditions were held constant. The Box–Wilson composite design was used in the experimental system, and to generate quadratic equations relating system performance to the operating conditions. Author

N70-12910*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GUIDELINES FOR EVA DEVELOPMENT
14 Dec. 1967 40 p
(NASA-TM-X-62554) Avail: CFSTI CSCL 06K

Projected guidelines for Apollo and post-Apollo EVA, based on Gemini experience, are briefly described. The development of techniques, methods, and hardware to extend capabilities, and the breaking down of major tasks into subtasks are mentioned. Implementation of the program is considered, and emphasis is placed on life support systems, crew and equipment mobility, work site technology, and information dissemination. An EVA task analysis and plans for planetary surface exploration are included. N.E.N.

N70-12986# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Life Sciences Section.
A REGRESSION ANALYSIS OF PILOT-INDUCED OSCILLATION RATINGS
Jay Eichler May 1969 26 p ref
(RM-444) Avail: CFSTI

Pilot-induced oscillation (PIO) ratings and step response data published previously were analyzed to determine the important variables in the step response and their correlation with the PIO ratings. A least square regression surface was fitted to various parameters of the step-response time-histories. The results have given direction to a larger study of handling qualities by indicating significant step-response parameters that correlate with PIO and the relative ordering of these parameters. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-12713# United Kingdom Atomic Energy Authority, Culcheth (England).

THE GAS CHROMATOGRAPHIC ANALYSIS OF CARBON DIOXIDE BASED GAS MIXTURES USING MOLECULAR SIEVE 13X AND TEMPERATURE PROGRAMMING

H. L. Robinson and J. A. J. Walker 13 Mar. 1969 4 p refs

(TRG-REPORT-1850) Avail: CFSTI

An analytical technique for determination of permanent gases in carbon dioxide is described. At a chromatographic column temperature of 100 C, the retention volume of CO2 on a molecular sieve is large compared with the retention volumes of the permanent gases. However, for a high sampling frequency, or for automation of the analysis, the CO2 may be removed rapidly from the column, after elution of the permanent gases, by raising the column temperature to 300 C for 20 min, followed by forced cooling to the original operating temperature. Author (NSA)

N70-12719*# Wyoming Univ., Laramie. Dept. of Physics.

AN EXPERIMENTAL INVESTIGATION OF HARRINGTON'S THEORY OF INTENSITY MEASUREMENTS Status Report, 1 Jan. 1967 - 1 Jan. 1969

Edgar A. Rinehart 1 Jan. 1969 20 p refs

(Grant NGR-51-001-010)

(NASA-CR-107171) Avail: CFSTI CSCL 07D

The necessary procedures are determined for performing quantitative analyses of polar gases in gaseous mixtures. Experiments show that spectrometer signal is a linear function of partial pressure of the absorber over a pressure range above 3.5 millitorr for pure gases. The linear range extends to much lower pressures for gases of much higher dilution. Accurate partial pressure measurements of individual components in a gaseous mixture are feasible. Operator errors which tend to make the data unreliable are reduced by performing operations under control of a small computer. The methods discussed permit determination of concentrations in the parts per million range and ultimate sensitivity is estimated at several parts per billion. R.B.

N70-12725# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

THE N-REPRESENTABILITY PROBLEM

Mary Beth Ruskai (Ph.D. Thesis) 10 Jul. 1969 159 p refs Sponsored in part by NSF

(PB-185188; WIS-TCI-346) Avail: CFSTI CSCL 07D

The N-representability problem is the problem of determining when a p-matrix (a certain type of function of 2p particles) is actually the p-th order reduced density matrix of an N-particle state function or ensemble density matrix of the appropriate symmetry. A comprehensive review of N-representability and related topics is given. Several new results for pure fermion N-representability are obtained by considering special kinds of preimages. The most important results are: sufficient conditions on the 2-matrix when N is odd; circumstances under which these sufficient conditions become necessary; necessary conditions on the 1-matrix for a single-excitation preimage; and necessary and sufficient conditions on the 2-matrix when the 1-rank is N+2. The N-representability problem for the 2-matrix has been studied by considering conditions on sets of geminals. This leads to a new formation of the problem. In certain circumstances, this approach can give a solution to the N-representability problem. Author (USGRDR)

N70-12738*# Texas Univ., Austin. Electronic Materials Research Lab.

RESEARCH ON DIGITAL TRANSDUCER PRINCIPLES, VOLUME 7: DIELECTRIC PROPERTIES OF THIN POLYMER FILMS, 1 JULY 1967 30 JUNE 1968

Yen Shan Chuang and William H. Hartwig 30 Jun. 1968 74 p refs

(Grant NGR-44-012-043)

(NASA-CR-107172) Avail: CFSTI CSCL 07C

Thin films of polymerized DC-704 oil, ranging in thickness from 50 A to 1000 A, can be formed by electron beam bombardment with reasonable good reliability and compatibility. The characterizing properties are strongly dependent on the method of preparation and environmental conditions. Experiments were conducted on metal-polymer-metal structures to investigate the characteristics. It is found that there are two dielectric relaxations in the film, a high frequency dispersion with a low frequency dispersion superimposed. The experimental capacitance-time curves show a decrease in capacitance with aging for every specimen. On further analysis it becomes clear that the percentage decrease in capacitance is a bulk function rather than a surface function and is attributable to the absorption of oxygen. Temperature dependence of capacitance is consistent with Debye relaxation and Maxwell Wagner interfacial polarization. Author

N70-12745# United Kingdom Atomic Energy Authority, Harwell (England).

VOIDS, FRICTION AND VIBRATIONS ASSOCIATED WITH LOCALISED BOILING

P. Gregorio and C. Merlini 1968 34 p refs Transl. into ENGLISH from Italian J. Presented to the 20th Congr. of the Assoc. Termotecnica Italiana

(PB-185833T; AERE-Trans-1114; PT-IN-24) Avail: CFSTI CSCL 07A

Local or subcooled boiling gives rise to specific conditions for the formation of volmetric quantities of vapor or voids, or of friction if the liquid is in motion along the heating wall. Several experimental observations indicate the occurrence of vibration processes, frequently of an acoustic nature, in this type of boiling. Tests have been in progress on the dynamics of natural circulation of water from pressures of 60 kg/sq. cm to beyond the critical point. Since instability phenomena, which are the subject of this type of investigation, have been regularly encountered before reaching saturation at the outlet and while local boiling is observed in the pipe under test, an analysis is made in the report of this type of heat transfer from the standpoint of the results set out above. Author (USGRDR)

N70-12759# Los Alamos Scientific Lab., N. Mex.

APPARENT OSCILLATOR STRENGTH DEPRESSION IN CESIUM-NOBLE GAS MIXTURES AT LOW PRESSURE

J. E. Solid Feb. 1969 16 p refs

(Contract W-7405-eng-36)

(LA-4120) Avail: CFSTI

The effects of noble gas perturbers on alkali absorption line spectra are reviewed. Particular attention is given to the depression of derived or apparent oscillator strengths for the cesium-noble gas systems. This effect may be due to molecule formation of perturber and absorber atoms and/or to invalidity of analytical methods in the low pressure regime. The problem is discussed and illustrated with data obtained for the low pressure regime. Values for the optical collision diameter in the cesium-argon and cesium-krypton systems are reported. The former agrees with a previously reported value; the latter has not been reported. Author (NSA)

N70-12788*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE STABILITY AND CATALYTIC ACTIVITY OF COPPER COMPLEXES OF SOME PEPTIDES [ISSLEDOVANIYE USTOYCHIVOSTI I KATALITICHESKOY AKTIVNOSTI MEDNYKH KOMPLEKSOV NEKOTORYKH DIPEPTIDOV]
U. I. Salakhutdinov et al. Washington NASA Dec. 1969 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Tadzh. SSR (USSR), v. 11, no. 11, 1968 p 34–36
(Contract NASw-1692)
(NASA-TT-F-12650) Avail: CFSTI CSCL 07C

The authors describe an experiment to determine the constants of stability and acid dissociation in copper complexes formed with several dipeptides. The hydrolysis reaction of pi-nitrophenylacetate is used as a model reaction. Author

N70-12780# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
THERMAL EVOLUTION OF GASES BOMBARDED INTO COPPER-NICKEL ALLONS
A. W. Smith Aug. 1969 15 p refs
(AD-692664; D1-82-0884) Avail: CFSTI

Copper, nickel, a 20/80 and a 50/50 copper-nickel alloy were argon ion bombarded in a 400V glow discharge. The rate of thermal evolution of the argon was determined during a linear temperature rise. At least 3 peaks in the thermal evolution curves of all samples were found below 800K. This thermal evolution was influenced by the alloy composition and by carbon monoxide adsorption after bombardment. After hydrogen bombardment evolution occurred only at low temperatures. After nitrogen bombardment evolution occurred only at high temperatures. Greatly enhanced uptake of hydrogen occurred after previous nitrogen bombardment. Author (TAB)

N70-12801# Air Force Cambridge Research Labs., Bedford, Mass.
IONIZATION CURVES FOR SECONDARY IONS IN MASS SPECTROMETER ION SOURCES
U. Lauterbach Jun. 1969 28 p refs Transl. into ENGLISH from Z. Naturforsch. (Tuebingen), v. 23a, 1968 p 1386–1391
(AD-692763; AFCRL-69-0277; AFCRL-Trans-50) Avail: CFSTI CSCL 7/4

An automatic version of the R.P.D. (Retarding Potential Difference) method was developed for obtaining digital ionization curves of secondary ions by using counting techniques and a multi-channel analyzer. The application of an indirectly heated sintered Nickel cathode yielded ca. 40 percent of the total electron current within an energy range of 0.1 eV. The R.P.D. ion source in connection with the automation circuit and a conventional mass spectrometer were used to investigate the formation of KrD(+) ions in Kr-D2 mixtures. It is shown that besides the well known reaction Kr(+) + D2 yields KrD(+) + D the complementary reaction D2(+) + Kr yields KrD(+) + D contributes considerably to the KrD(+) yield. A rather small contribution of the neutral reaction Kr(*) + D2 yields KrD(+) + D + e(-), found earlier by Hotop, could be confirmed. Strong evidence was found for the existence of a reaction path D2(*) + Kr yields KrD(+) + D + e(-) by longlived exited states of D2 above the first ionization limit of D2. Author (TAB)

N70-12805# Boeing Scientific Research Labs., Seattle, Wash. Polymer Sciences Lab.
POLY-1,2,4-TRIAZOLES AND POLY-1,3,4-OXADIAZOLES FROM PRECURSOR POLY-N-ACYLHYDRAZIDINES
Paul M. Hergenrother Aug. 1969 31 p refs Presented at 158th Natl. ACS Meeting, New York, Sep. 1969 Submitted for publication
(AD-692676; D1-82-0886) Avail: CFSTI

High molecular weight soluble poly-N-acylhydrazidine was prepared from low temperature solution polycondensation of 2,6-pyridinedicyl dihydrazidine with isophthaloyl chloride. Poly-N-acylhydrazidine was converted by heating in strong acids such as trifluoroacetic to the corresponding poly-1,3,4-oxadiazole. Whereas, conversion of the precursor poly-N-acylhydrazidine predominantly to poly-1,2,4-triazole was affected by refluxing in solvents such as m-cresol or by solid state advancement at 280 to 350C under an inert atmosphere. The poly-1,2,4-triazole was contaminated with 1.4 to 4.0% 1,3,4-oxadiazole depending upon the heating rate. Poly-N-acylhydrazidine was of sufficient molecular weight to cast a clear yellow film which exhibited good flexibility. The film, upon thermal treatment to temperatures as high as 300C, became brittle. The poly-1,3,4-oxadiazole and poly-1,2,4-triazole exhibited thermal decompositions by TGA between 450 and 520C. Prior to polymer synthesis, a series of model compounds were prepared as a guide to polymer synthesis and identification. Author (TAB)

N70-12839# Columbia Univ., New York.
RADIATION EFFECTS IN POLYMERIC SYSTEMS Final Report, 1 Nov. 1965–31 Oct. 1968
George Odian 17 Aug. 1969 5 p refs
(Grant DA-ARO-D-31-124-G716)
(AD-693299) Avail: CFSTI CSCL 7/5

An investigation of radiation-induced graft polymerization and crosslinking in polymer-monomer systems is reported. Alterations in monomer reactivities in graft polymerizations and the interaction of diffusion and graft polymerization were studied. Author (TAB)

N70-12851# Mason and Hanger-Silas Mason Co., Inc., Burlington, Iowa.
A RAPID GAS-LIQUID CHROMATOGRAPHY METHOD FOR THE QUANTITATIVE ANALYSIS OF 1,1,2 TRICHLORO 1,2,2 TRIFLUORO ETHANE (FREON 113) IN AIR
T. W. Stull 10 Oct. 1968 14 p refs
(Contract W-49-010-AMC-68)
(AD-679035; MHSMB-3; TR-163) Avail: CFSTI

A rapid method is described for the quantitative determination of 1,1,2 trichloro 1,2,2 trifluoroethane (Freon 113) in atmospheric concentrations ranging from 1 to 1000 ppM. This gas-liquid chromatographic method utilizes the flame ionization detector and employs a unique method of standardization. The standard can be prepared and a complete concentration range chromatographed and graphed in approximately fifteen minutes. Both lower and higher concentrations can be determined by adjustment of the prepared standard, instrument conditions, or sample size injected. The method outlined was used for approximately two years and proved both reliable and accurate. Its advantage lies in the ease, simplicity, and rapidity of both standardization and subsequent analysis. Author (NSA)

N70-12888# California Univ., Berkeley. Lawrence Radiation Lab.
HEATS OF TRANSFORMATION AT THE CURIE POINT IN THE LEAD TITANATE-LEAD ZIRCONATE SYSTEM
John Edward Playter (M.S. Thesis) Aug. 1969 41 p refs
(Contract W-7405-eng-48)
(PB-186338; UCRL-19057) Avail: CFSTI CSCL 20C

The phase transformation at the Curie point in the lead titanate-lead zirconate system was studied by determining the heats of transformation and the changes in crystal structure in the transformation. This work was confined to the titania rich portion of the system with a tetragonal crystal structure. The transformation in this system consisted of a change from a low temperature tetragonal phase, which had ferroelectric properties, to a high temperature cubic phase, which had paraelectric properties. An increase in the concentration of lead zirconate in the system was shown to reduce the heat of transformation. This reduction resulted from a decrease in the tetragonality of the crystal structure with increasing lead zirconate concentration, which reduced the change in crystal structure during the transformation. Author (USGRDR)

N70-12899# Oak Ridge National Lab., Tenn.
MICROSPHERE FORMING CONDITIONS FOR THORIUM DIOXIDE-URANIUM TRIOXIDE SOLS: A FACTORIAL EXPERIMENT
K. J. Notz and A. B. Meservey Aug. 1969 57 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2516) Avail: CFSTI

The effects of three variables related to the sphere forming column solvent (2-ethyl-1-hexanol) on the properties of microspheres produced from ThO2-UO3 sols were examined by means of a 2 cubed factorial experiment. The three variables tested were: water content (0.4 and 1.6 vol %), acid concentration (0.001 and 0.01 N), and Ethomeen S/15 content (0.05 and 0.5 vol %). Representative photographs of the product microspheres are included. It was found that the solvents having low Ethomeen concentrations gave products with the least cracking and deformation. Also, it was shown that two solvent cross effects are prominent, namely, acid x Ethomeen, and water x Ethomeen. Five ThO2-UO3 sols were tested in each of the eight solvents comprising the factorial design. Four of the sols had been prepared by concurrent solvent extraction. The fifth sol was prepared by countercurrent extraction and had a low nitrate/metal ratio. The factorial design was replicated with three of the sols; in general, replication was good.
Author (NSA)

N70-12914# National Standard Reference Data System.
HIGH TEMPERATURE PROPERTIES AND DECOMPOSITION OF INORGANIC SALTS. PART 2: CARBONATES
K. H. Stern (NRL, Washington, D.C.) and E. L. Weise (US Patent Office) Nov. 1969 34 p refs
(NSRDS-NBS-30-Pt-2) Avail: SOD $0.45

The literature dealing with the high-temperature behavior of inorganic carbonates has been critically reviewed. Free energy functions of reactants and products of the decomposition reactions were calculated and have been tabulated from 298 K up to as high a temperature as possible. Free energy functions and equilibrium constants of reactions were tabulated. Auxiliary data on phase transitions, densities, and kinetics of thermal decomposition have also been included. The literature of the endothermic decomposition kinetics of solids, as it applies to carbonates, has been reviewed.
Author

N70-12933*# State Univ. of New York, Stony Brook. Coll. of Engineering.
DIELECTRIC STUDIES OF THE CATION SUBSTITUTED MIXED CRYSTALS OF NIOBATES Annual Report, 1 Jun. 1968 - 1 Jun. 1969
Franklin F. Y. Wang 1 Jun. 1969 47 p refs
(Grant NGR-33-015-085)
(NASA-CR-107198; AR-1; Rept-149) Avail: CFSTI CSCL 07D

The preparation and compositions of Gd-substituted Ba2NaNb5O15 is discussed. The properties under study included the lattice parameters, density, linear thermal expansion, dielectric constant, microstructure, and electrical conductivity. Some of the measuring setups are described and discussed. From the linear thermal expansion data, phase transitions were shown in these niobate samples. An approach, which related empirical factors of cations with the ferroelectric transition temperatures, is included.
Author

N70-12981# State Univ. of New York at Buffalo. Dept. of Chemistry.
GENERATION AND PROPERTIES OF IMINIUM CATIONS AND RELATED ELECTRON-DEFICIENT NITROGEN INTERMEDIATES Final Report, 1 Sep. 1966 - 31 Aug. 1969
Peter T. Lansbury Sep. 1969 7 p refs
(Grant DA-ARO(D)-31-124-G851)
(AD-693303; AROD-6418-6-C) Avail: CFSTI CSCL 7/3

Iminium cations can be generated by ionization of oxime polyphosphates of rigid ketones incapable of rearrangement and fragmentation. This report summarizes a research effort to determine whether singlet or triplet ions are involved as intermediates in appropriate compounds when they react to produce C-H insertion and non-stereospecific rearrangement products. Another goal of this research was to find substrates where remote intramolecular nucleophilic attack at nitrogen would supercede the conventional Beckmann isomerization.
Author (TAB)

N70-12982# Florida State Univ., Tallahassee.
REACTIONS OF FREE RADICALS Final Report, 1 Jul. 1962 - 31 Aug. 1967
John E. Leffler 28 Aug. 1969 20 p refs
(Grants DA-ARO(D)-31-124-G730; DA-ARO(D)-31-124-G355; DA-ARO(D)-31-124-G373)
(AD-693297; AROD-3605-4-C) Avail: CFSTI CSCL 7/4

The esr spectra of a series of triarylboron anion radicals show selective line broadening effects. The cleavage of triphenylboron by alkali metals in DME has been shown to give biphenyl in boron molecule. Several reactions of diarylboron derivatives with alkali metals are also discussed. Also given are brief summaries of research on the cleavage of triptycene and quinolizinium ions by alkali metals, and on the decomposition of cumyl perchlorate.
Author (TAB)

N70-12987# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Chemie.
LABELLING OF OILS WITH CHROMIUM-51
M. Michailov (Reactor Centre, Sofia) and H. Sorantin 1969 8 p refs Sponsored by IAEA
(SGAE-CH-60/1969) Avail: CFSTI

Oil-soluble Cr-51 compounds were prepared by irradiation of chromium metal powder, dissolution in hydrochloric acid and direct extraction with naphthenic or oleic acid, rape oil, triolein etc. Cr-51 could also be isolated as acetylacetonate from the aqueous phase. The chelate proved to be miscible with mineral or vegetable oils without additives or intermediary solvents.
Author

N70-13018# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Kernverfahrenstechnik.
SEPARATION NOZZLE PROCESS FOR URANIUM ENRICHMENT
E. W. Becker Jun. 1969 17 p refs Presented at the Atomforum Conf., Utrecht, 30 May 1969
(KEK-1002) Avail: CFSTI

In the separation nozzle process, a mixture of about 5 mole % UF6 and 95 mole % He is expanded through a slit-shaped nozzle. Operation of a 10-stage pilot plant for this process is described. A method for inexpensive mass production of separation nozzle systems was developed. Economic aspects are discussed.
NSA

N70-13038# Arizona State Univ., Tempe.
THE SOLID STATE CHEMISTRY OF RARE EARTH OXIDES Technical Progress Report, 1968 - 1969
Leroy Eyring, Claude C. Herrick, Michael S. Jenkins, Donald L. Fox, Rheal P. Turcotte et al 10 Jul. 1969 122 p refs
(Contract AT(11-1)-1109)
(COO-1109-46) Avail: CFSTI

Developments are reported for studies on: an accurate automatic read-out for thermobalances; pseudo-phase behavior in the praseodymium oxide system; the praseodymium oxide system; rare earth formates; yttrium sesquioxide; heterogeneous oxygen exchange behavior of a sample of PrO spheres; equilibrium dissociation studies at low oxygen pressures; and single crystal growth using hydrothermal techniques.
NSA

N70-13039# Atlantic Richfield Hanford Co., Richland, Wash. Separations Chemistry Lab.
RECOVERY OF RHODIUM, PALLADIUM, AND TECHNETIUM ON STRONGLY BASIC ANION EXCHANGE RESIN
J. V. Panesco Jul. 1969 21 p refs
(Contract AT(45-1)-2130)
(ARH-1279) Avail: CFSTI

Selective ion exchange recovery of palladium, rhodium, and technetium from nuclear reprocessing wastes was demonstrated by use of two resin columns in series. Partial separation of palladium from rhodium and technetium was obtained in the loading step of the first column where a cumulative 90 per cent Pd, 37 per cent Rh, and 23 per cent Tc were recovered from 900 bed volumes. Ninety per cent of the remaining Rh, Tc, and Pd was recovered on the second column when less than 300 bed volumes of Column 1 effluent were used per loading cycle. Rhodium and technetium were selectively eluted with HNO3; and, subsequently, palladium was eluted with NH4OH. Uneluted Rh, Pd, and Tc were simultaneously removed with NH4SCN. Author (NSA)

N70-13042# United Kingdom Atomic Energy Authority, Harwell (England).
COOLANT MIXTURES INVOLVING HIGHLY DISPERSED LIQUID IN SUPERHEATED VAPOUR
M. Cumo Jul. 1968 27 p refs Transl. into ENGLISH from the French
(PB-185823T; AERE-Trans-1115) Avail: CFSTI CSCL 07A

The paper examines the conclusions drawn from the literature on highly dispersed liquid in currents of vapours or gases, setting them out in sections concerning the characteristics parameters of the drops. On the basis of the previously assembled data, a theoretical procedure is formulated for deducing the characteristic dimensionless groups of the system and the conditions of similitude for the thermodynamic phenomena associated with heat exchange. Author (USGRDR)

N70-13053# Washington Univ., Seattle. Dept. of Chemistry.
COMPARATIVE STUDIES OF THE CATALYTIC FLUORINATION OF CARBON MONOXIDE WITH ELEMENTARY FLUORINE
Manfred Wechsberg and George H. Cady Nov. 1968 24 p refs
(Contract N00014-67-A-0103)
(AD-677930; TR-66) Avail: CFSTI CSCL 07B

AgF2 is a catalyst for the reaction, CO + F2 = CF2O and for subsequent changes in which COF2 reacts with fluorine to give CF3OF and CF3OOCF3. Cesium fluoride aids in the production of CF3OF but no CF3OOCF3 from fluorine and COF2. Author

N70-13054# Ohio State Univ. Research Foundation, Columbus. Dept. of Metallurgical Engineering.
AN INVESTIGATION OF MIXED CONDUCTION IN SOLID ELECTROLYTES Progress Report
Robert A. Rapp 14 Aug. 1969 9 p
(Contract AT(11-1)-1440)
(COO-1440-17) Avail: CFSTI

Developments are reported for studies on proton conduction in oxide electrolytes and mixed conduction and ionic equilibria in molten NaCl-TiClx solutions. Also the apparatus for the measurement of free energy of formation of UO2 has been completed. The results on proton conduction verified partial proton conductivity in ThO2-based solutions and established the dependence of proton conductivity on temperature, vacancy concentration, and partial pressures of O and of H. The theoretical treatment and electrochemical cell for mixed conduction studies are described. Author (NSA)

N70-13080# United Technology Center, Sunnyvale, Calif. Stanford Univ., Calif.
SEVENTH AFOSR CONTRACTOR'S MEETING ON CHEMICAL KINETICS OF PROPULSION: AGENDA AND ABSTRACTS
[1968] 36 p refs Prepared jointly by United Technol. Center and Stanford Univ.
(Contract AF 49(638)-1489)
(AD-678208; AFOSR-68-1391) Avail: CFSTI CSCL 07D

Abstracts are given for the reports on chemical kinetics of propulsions presented at the 7th annual AFOSR Contractor's meeting. TAB

N70-13181# Houston Univ., Tex. Dept. of Chemistry.
REACTIONS BETWEEN ELECTRONS AND BIOLOGICAL SUBSTANCES Final Report, 1 Jun. 1966 - 31 May 1969
Albert Zlatkis Jun. 1969 10 p refs
(Contract AT(40-1)-3541)
(TID-25162) Avail: CFSTI

New instrumentation was developed for studying compounds that have a large cross section for electron absorption. A Ni-63 detector has proven extremely sensitive and capable of operation to 400 C. A corona discharge cell was designed for reacting organic compounds with electrons at thermal energy. Several compounds were reacted using this cell and the products analyzed by gas chromatography-mass spectrometry. Dissociative or non-dissociative mechanisms can be interpreted from this information. A number of derivatives that are potentially useful in electron absorption studies were prepared. These can be applied to compounds of biological interest by making them detectable in trace quantities, e.g., steroids. The possible use of the electron capture technique as a means of spectroscopy was also initiated. The results indicate that applications may be possible in analytical gas chromatography. Author (NSA)

N70-13229# California Univ., Livermore. Lawrence Radiation Lab.
THEORETICAL PROBLEMS IN FLUORESCENCE
Zen-Ichi Yoshida May 1969 29 p refs Transl. into ENGLISH from Bunseki Kagaku, (Tokyo), v. 17, no. 7, 1968 p 871 - 878
(PB-186065T; UCRL-TRANS-10352) Avail: CFSTI CSCL 07E

A general discussion is presented on fluorescence which includes the following topics: Nonradiative loss of excitation energy; Fluorescence and molecular structure; Factors affecting the fluorescence (temperature, solvent, pH, concentration, heavy halides, oxygen, metal ions). USGRDR

N70-13230# Denver Univ., Colo. Dept. of Physics.
LINE PARAMETERS OF THE INFRARED METHANE BANDS Scientific Report
Thomas G. Kyle Oct. 1968 53 p refs Prepared for AFCRL
(Contract AF 19(628)-5706)
(AD-678184; AFCRL-68-0521; SR-1) Avail: CFSTI CSCL 7/4

The line positions and strengths for the mu2, mu3, and mu4 bands of methane are listed. Some of the required approximations are discussed and the results of calculations using the line parameters are compared with experimental data. Author (TAB)

N70-13232# Raytheon Co., Waltham, Mass. Mass Research Div.
CRYSTAL CHEMISTRY AND MAGNETIC RESONANCE PROPERTIES OF THE VANADATE GARNETS Final Report, 15 Sep. 1966 - 14 Jul. 1968
H. J. Van Hook, T. Kohane, and F. K. Euler (AFCRL) Oct. 1968 103 p refs Prepared for AFCRL
(Contract F19628-67-C-0054)
(AD-678092; S-1102; AFCRL-68-0467) Avail: CFSTI CSCL 20/12

Vanadate garnet compositions in the series (Y (3-2x)Ca2x) (Fe (5-x-y)InyVx)O12 have been prepared as single crystals by the PbO flux method and as high density polycrystaline ceramics. The single crystals were examined by electron microprobe which showed constant indium concentration for O = or < y = or < 0.35 but a well-defined zoning effect in calcium-vanadium content for O = or < x = or < 1.2. Good agreement was obtained from magnetization, Curie point, and X-ray parameter between single crystal and corresponding polycrystalline compositions. In polycrystalline vanadate garnets the addition substitution of indium causes a substantial reduction in linewidth when microstructural influences are minimized. In dense ceramice delta H can be quantitatively correlated with magnetic anisotropy using recent theories developed by Schlomann. Author (TAB)

N70-13238# Horizons, Inc., Cleveland, Ohio.
SYNTHESIS OF NEW LOW TEMPERATURE PETROLEUM RESISTANT ELASTOMERS Final Report, 27 Feb. 1968 - 27 Feb. 1969
Selwyn H. Rose and James Cable Mar. 1969 114 p refs
(Contract DAAG17-68-C-0096)
(AD-693289; AMMRC-CR-69-27(F)) Avail: CFSTI CSCL 11/10

A copolymer was developed to fill the need for chemical-resistant elastomers which retain rubberlike properties over the range -65 to 600F and retain high strength in the presence of petroleum solvents. The copolymer, (NP(OCH2CF3)2 - NP(OCH2C3F7)2)n, is an elastomer with a glass transition temperature of -77C that has an initial decomposition point of 300C in air. Films of the copolymer have the rubbery physical properties generally associated with high molecular weight uncrosslinked elastomers. The elastomer appeared unaffected by prolonged immersion in boiling water, common organic solvents, concentrated sulfuric acid, and concentrated potassium hydroxide, as well as by organic bases such as pyridine and formamide. It was soluble, however, in a mixture containing 89% trichloro-trifluoroethane and 11% acetone. When placed in a direct flame, the material softened and vaporized but would not burn. The copolymer, (NP(OCH2CF3)2 NP(OCH2C3F7)2)n, thus appears promising for utilization in extreme low temperature and/or chemically corrosive environments and has a thermal stability that is very respectable for such a low Tg elastomer. Author (TAB)

N70-13271# Gulf General Atomic, San Diego, Calif.
INTERACTIONS BETWEEN HYDROGEN AND OXYGEN ATOMS AND SURFACES Final Report, 1 Oct. 1964 - 30 Sep. 1968
Joe N. Smith, Jr. 25 Oct. 1968 50 p refs
(Contract AF 49(638)-1435)
(AD-678166; GA-8898; AFOSR-68-2581) Avail: CFSTI CSCL 7/4

The results of experimental studies of molecular beam-surface scattering studies are summarized. These studies include the scattering distributions of H2, D2, HD, He, Ne, Ar, and Xe at thermal energies less than 0.3 eV from Au, Ag, Ni, LiF, and mica. Continuous evaporative deposition was used to provide clean, epitaxially grown single crystals in the case of the metal scattering surfaces. A complete list of reports, publications, and formal tables resulting from this research is also included. Author (TAB)

N70-13276# Chicago Univ., Ill. Dept. of Chemistry.
RADIATION CHEMISTRY OF ORGANIC COMPOUNDS Final Report, 1 Jun. 1968 - 31 May 1969
N. C. Yang 31 May 1969 6 p refs
(Contract AT(11-1)-1043)
(COO-1043-3) Avail: CFSTI

Developments are reported for studies on: photochemistry of polyhalomethanes; attempted generation of tropylium and related systems by radiochemical methods; and charge-transfer interactions in organic polymers and organic semiconductors. NSA

N70-13298# California Univ., Berkeley. Lawrence Radiation Lab.
DIARYL AND TRIARYL OXAZIRIDINES
Howard K. Ono (Ph.D. Thesis) Jun. 1969 242 p refs
(Contract W-7405-eng-48)
(PB-184914; UCRL-19217) Avail: CFSTI CSCL 07C

A study of the rates of rearrangement of 2,3-diaryl and 2,3,3-triaryloxaziridines to the corresponding amides has been made. From the effects of solvent and from the behavior of a series of substituted compounds, it can be concluded that rearrangement involves heterolytic N-O bond fission with synchronous migration of a group from the carbon to the nitrogen. Aryl migration in the 2,3-diaryloxaziridines involves a significant amount of charge separation while hydrogen migration in the diaryl system and aryl migration in the triaryl system involve considerably less charge. The isolation of stable crystals of suitably substituted 2,3-diaryloxaziridines and 2,3,3-triaryloxaziridines from the photolysis of the corresponding nitrones firmly establishes the oxaziridines as the primary photoproduct from irradiation of N-arylnitrones. Author (USGRDR)

N70-13318# California Univ., Livermore. Lawrence Radiation Lab.
THE 3-DETAILED EXPOSITION: 3.1 FLUORESCENCE ANALYSIS OF INORGANIC SUBSTANCES
Y. Nishikawa, I. Amano, Y. Tamura, K. Yagi, and S. Nishikimi May 1969 40 p refs Transl. into ENGLISH from Bunseki Kagaku, (Tokyo), v. 17, no. 7, 1968 p 888 - 897
(PB-186063T; UCRL-TRANS-10351) Avail: CFSTI CSCL 07D

Fluorescence or fluorometric analysis depends on the phenomenon of fluorescence, characteristic of many substances, and is useful as a specific method for microdetermination. Summarized briefly are the principal methods of fluorometric analysis for a number of elements. Since the sensitivity of a fluorometric determination varies considerably with the measuring instrument and concentration of the setting solution, the determination ranges given below are only rough estimates. The compounds discussed are aluminum, boron, beryllium, europium, fluorine, gallium, indium, lithium, magnesium, molybdenum, antimony, scandium, selenium, tin tantalum, thallium, uranium, tungsten, yttrium, zinc, and zirconium. Author (USGRDR)

N70-13321# Sandia Corp., Albuquerque, N.Mex.
OBTAINING COBALT-BLUE AND CHROMIUM-PINK MINERAL STAINS OR DYES OF THE SPINEL TYPE [POLUCHENIE KOBALTOVYKH GOLUBYAH I KHROMOVYKH ROZOVYKH MINERALNYKH KRASITELEI SHPINELNOGO TIPA]
S. G. Tumanov 12 Sep. 1969 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSR, (Russia), v. 57, no. 1, 1947 p 69 - 72
(PB-186095T; SC-T-69-1042) Avail: CFSTI CSCL 11C

Obtained was a whole series of light-blue cobalt colored and pink chrome pigments of the following ismorphous series: CoO--A1203; CoO--MgO--Al203; CoO--ZnO--I203; Al203--Cr203; MgO--Al2O3--Cr2O3; ZnO--Al2O3--Cr2O3. A measurement of a light refraction of the obtained pigments, their petrographic and X-ray studies, as well as the photographed thermograms demonstrated that the new pigments present predominately a compound of the spinel type. The pigments of the zinc series possess the highest degree of homogeneity among all the obtained series. The greatest stability of pigment in relation to the dissolving action of acids was established also in the case of the zinc-type pigments. The procedure of annealing a dense mixture of oxides with boric acid likewise ensures a complete formation of spinels and appears to be practically the simplest and more convenient method to be utilized under industrial conditions of productions. Author (USGRDR)

N70-13322# Furman Univ., Greenville, S.C. Oak Ridge National Lab., Tenn. Dept of Chemistry.
DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS. PART 2: REMOVAL OF IODINE AND METHYL IODIDE FROM AIR BY LIQUID SOLUTIONS
Stuart C. Patterson and William T. Humphries Aug. 1969 30 p refs Prepared for Oak Ridge National Lab.
(Contract W-7405-eng-26)
(ORNL-TM-2412-Pt-2) Avail: CFSTI

Experimental techniques for studying the efficiency of removal of elemental iodine and methyl iodide from air streams by reactive aqueous solutions are described. The procedures are designed to allow rapid comparisons under conditions which simulate those encountered in spray or pressure-suppression-pool applications. A gas-titration procedure for comparing the iodine-scrubbing capabilities of solutions is described, and the results of its use in screening approximately 100 solutions and mixtures are reported. A detailed comparison sodium hydroxide and Na sub 2 S sub2 0 sub 3 is made. A gas-chromatographic method for comparing the relative rates of methyl iodide uptake is described, and results for several of the best additives are reported. Conclusions and recommendations for spray and pool systems are included.
Author (NSA)

N70-13366# Avco Corp., Lowell, Mass. Space Systems Div.
A SURVEY OF METAL OXIDES AS SORBENTS FOR OXIDES OF SULFUR Final Report
Feb. 1969 85 p
(PB-185190; AVSSD-0043-69-RR) Avail: CFSTI CSCL 07A

Seventeen metal oxides, on one or more supporting oxides, were evaluated for their sorbing and regenerating characteristics. The sorbents investigated were for the most part made by co-precipitation of the hydroxides of the "active" and 'supporting' oxides followed by calcining, analogous to the preparation of alkalized alumina. Several catalyst supports impregnated with the 'active oxide' as well as commercially available materials were also evaluated. The extent and rate of sorption and regeneration of these materials was determined by following the weight change of a sample exposed to a synthesized typical flue or regenerating gas with time. On comparison one finds that some of the copper oxide-alumina and manganese oxide-alumina sorbents give generally good performance as sorbents.
Author (USGRDR)

N70-13379# Oak Ridge National Lab., Tenn. Isotopes Div.
ELECTROMAGNETIC SEPARATION AND CHEMICAL REFINEMENT OF TUNGSTEN ISOTOPES
L. O. Love, K. A. Spainhour, W. A. Bell, W. C. Davis, R. L. Johnson et al Jul. 1969 36 p refs
(Contract W-7405-eng-26)
(ORNL-4405) Avail: CFSTI

More than 5 lb (2345 g) of W-184 with a purity of greater than 94% was separated and recovered from a series of runs made to enrich this isotope. For this separation the calutrons were equipped with boundary plates for stabilizing the beam and with an all-graphite, two-arc, single-oven ion source, which increased the average output of W(+). The increased input of feed (WO3) and chlorinating agent (CCl4) required in this two-arc system severely loaded the two 20-in. calutron diffusion pumps. Therefore supplementary pumping with vaporized calcium was employed. As a result, the operating pressures were lowered which improved the beam transmission, and the material collected had the highest purity (97.6%) achieved in the series.
Author (NSA)

N70-13395# Sandia Corp., Albuquerque, N.Mex.
DETERMINATION OF THE LIFETIMES OF THE 3 P AND 3 D STATES OF NE 2 [DETERMINATION DES DUREES DE VIE DE NIVEAUX 3 P ET 3 D DE NE 2]
A. Denis 4 Sep. 1969 6 p refs Transl. into ENGLISH from Comptes Rendus. (Paris), v. 268B, 3 Feb. 1969 p 383–385
(PB-186092T; SC-T-69-1039) Avail: CFSTI CSCL 07D

The lifetimes were measured by passing a beam of Ne(+) ions through a thin carbon target.
USGRDR

N70-13401# Wayne State Univ., Detroit, Mich. Dept. Of Physics.
DELAYED LUMINESCENCE IN ALKALI HALIDES UNDER F BLEACHING
C. Manilerd and Y. W. Kim [1969] 26 p refs
(Contract AT(11-1)-1054)
(COO-1054-43) Avail: CFSTI

Samples of NaF, LiF, NaCl sub 9 and KCl were x-irradiated (40 keV–20 mA) at 300 K for a few seconds to 20 minutes. The luminescence spectrum of these samples under F bleaching was studied with controlled time delay between bleaching and emission. The delayed luminescence (D.L.) of NaF and LiF gave spectra centered near 580 m mu with half-width close to 60 m mu. For KCl, the spectrum peaked at 420 m mu with half-width of 74 m mu. The corresponding spectrum of NaCl was not successfully resolved. The growth and decay of the D.L. for NaF are characterized by the activation energy: 0.014 + or – 0.002 eV and 0.024 + or – 0.002 eV. The effects of temperature were also investigated. Comparative analysis of the data appear to favor a model based on the recombination between a vacancy-pair with hole, and the electron released from an F center under F bleaching.
Author (NSA)

N70-13406# Defense Documentation Center, Alexandria, Va.
KRYPTON A DDC Bibliography, Jul. 1961–Feb. 1969
Sep. 1969 160 p refs
(AD-693500; DDC-TAS-69-56-1-Vol-1) Avail: CFSTI CSCL 7/4

This bibliography contains references ranging from physico-chemical properties to thermochemical data. References dealing with inter and intra-atomic collisions, retention by metals, photoionization cross sections, and krypton-filled thermionic converters are also discussed.
Author (TAB)

N70-13425# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
DILUTE GAS VISCOSITIES AT LOW TEMPERATURES
H. J. M. Hanley and G. E. Childs 19 Dec. 1968 2 p refs
(PB-186353; R-519) Avail: CFSTI CSCL 07D

Comments are given on a recent paper by Clarke and Smith (J. Chem. Phys. 48, 3988 (1968)) in which low temperature dilute gas viscosities are reported. Most of the discussion is on argon.
Author (USGRDR)

N70-13433# Kansas Univ., Lawrence. Dept. of Chemistry.
[ESR STUDIES ON TRAPPED SPECIES IN IRRADIATED SOLIDS] Progress Report
Peter L. Hamlet 20 May 1969 5 p
(Contract AT(11-1)-1807)
(COO-1807-1) Avail: CFSTI

Progress is reported on electron spin resonance studies on trapped species in irradiated solids. Frozen solutions of saturated alcohols were bombarded with H atoms at 77 K and the reactions monitored by ESR. Spatial distributions in calcium ion and silver ion doped alkali halide crystals were studied. Yields of F centers in the Ca(2+)-doped material were too low to be significant. Saturation measurements on gamma-irradiated silver-ion-doped KCl indicated an inhomogeneous distribution of Ag atoms with the radius of the average spur being about 80 A. Results indicated that the first optically allowed excited state of the trapped electron in irradiated 10M NaOH and glassy methanol at 77 K is weakly bound, if at all.
NSA

N70-13439# Army Electronics Command, Fort Monmouth, N.J.
MECHANISM FOR PROPANE ADSORPTION ON PLATINUM IN ACID ELECTROLYTES
Dorothy D. Williams Aug. 1969 16 p refs
(AD-693864; ECOM-3156) Avail: CFSTI CSCL 7/4

The mechanism of propane adsorption on platinum shows the interrelation of the solubility of propane in various electrolytes and the surface condition of the anode. It is shown that the initial rate of propane adsorption is influenced by the degree of oxidation of the electrode surface. Author (TAB)

N70-13440# Army Electronics Command, Fort Monmouth, N.J.
INFLUENCE OF ANIONS ON THE ANODIC OXIDATION OF PROPANE
John A. Christopulos Aug. 1969 23 p refs
(AD-693848; ECOM-3155) Avail: CFSTI CSCL 7/4

The rates of propane adsorption on a platinum anode in 0.1 and 1 normal acid solutions at 65C were investigated. The initial adsorption rates of propane in these acids were found in decreasing order to be: CF3CO2H > HClO4 > H2SO4. Acid anion effect was prevalent at potentials greater than 0.4 volts versus R.H.E. The lowest potential for maximum anodic oxidation of propane in all acid solutions was approximately 1 volt versus R.H.E. This propane oxidation potential appears dependent on the incipient formation of platinum oxides. Author (TAB)

N70-13442# Battelle-Northwest, Richland, Wash.
EXTRACTION BY SOLUTION-LIGHT ABSORPTION QUANTIFICATION OF THORIUM (IV) USING XYLENOL ORANGE
Makoto Otomo and Yoshinobu Wakamatsu Aug. 1969 11 p refs Transl. into ENGLISH from Nippon Kagaku Zasshi (Tokyo), v. 89, no. 11, 1968 p 1087 1089
(BNWRL-Tr-41) Avail: CFSTI

A new method is described for the spectrophotometric determination of thorium(IV), which is based on the extraction of thorium xylenol orange(XO) chelate into 1-butanol in the presence of 1,3-diphenylguanidine(DPG). The stable violet chelate in the organic phase has an absorption maximum at about 578 millimicron. The maximum and the constant absorbence is obtained when the pH of the aqueous phase is adjusted to 2.5 to 3.6. The effect of the concentrations of XO and DPG in the aqueous phase on the absorbence of the organic phase is examined, and the optimum conditions for the determination are deduced. A good linear relationship between the absorbence of the organic phase and the concentration of thorium is obtained in the concentration range from 2.8 to 16.6 milligram per 20.0 ml. The molar extinction coefficient of the extracted chelate is about 93000 at 578 millimicron, and the sensitivity of the reaction is 0.0020 milligram/sq cm for log I sub 0/I = 0.001. The composition of the extracted species is also discussed. Author (NSA)

N70-13469# Vanderbilt Univ., Nashville, Tenn. Dept. of Chemistry.
STUDIES IN RADIATION AND CATALYTIC CHEMISTRY BY MASS SPECTROMETRY, FLASH PHOTOLYSIS AND MAGNETIC TECHNIQUES Progress Report, 30 Sep. 1968 30 Sep. 1969
Thomas W. Martin Sep. 1969 8 p
(Contract AT(40-1)-2825)
(PB-186207; ORO-2825-21) Avail: CFSTI CSCL 07E

Brief summaries are presented of studies dealing with the following: Competitive electron transfer. Activity-defined formation constants of Ce (III) nitrate complexes using the NO3 free radical; Flash generation and decay kinetics of the NO3 radical in aqueous nitric acid solutions; NO3 radical; 'Soft' lattice preparation and pure ESR spectrum at 88K; EPR studies of some Cu (II) complexes with organophosphorus chelates. Author (USGRDR)

N70-13490# Aeronautical Research Labs., Melbourne (Australia).
CORROSION OF MAGNESIUM
K. F. Lorking Apr. 1969 26 p refs
(ARL-MET/76) Avail: CFSTI

Measurements of weight loss due to corrosion of magnesium have been made over a wide range of pH in decinormal solutions of sodium chromate, phosphate, benzoate, sulphate and chloride, also in water and alkali. The effect of the anion is found to be specific. Analysis of the corrosion processes showed that the oxide film on magnesium is neither as protective nor self healing as that on aluminium or zinc. It is inferred that corrosion products formed by magnesium play a significant part in the formation of protective films which inhibit corrosion in solutions of phosphate and alkali. Only chromate inhibits corrosion of magnesium over the entire pH range investigated. This is thought to be due to the formation of a mixed chromic-magnesium oxide at the oxide/solution interface. Author

N70-13492# Atomic Energy of Canada, Ltd., Chalk River, Ontario. Nuclear Labs.
CHEMISTRY AND MATERIALS DIVISION Progress Report, 1 Jul. 30 Sep. 1969
30 Sep. 1969 99 p refs
(AECL-3477; PR-CMA-10) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $2.00

Research progress is reported on deformation and radiation damage in solids, electron microscopy, ion penetration and atomic collision phenomena in solids, nuclear chemistry, radiation chemistry, isotope chemistry related to deuterium separation; diffusion, precipitation, and rare gas bubble formation in solids, and anodic oxidation. R.B.

N70-13494# Kernforschungsanlach, Juelich (West Germany). Zentralinstitut fuer Reaktorexperimente.
THE MAGNETIC PHASE DIAGRAM OF THE TERNARY MIXED CRYSTAL SYSTEM FERRIC OXIDE-CHROMIC SESQUIOXIDE-ALUMINUM OXIDE: A NEUTRON DIFFRACTION STUDY [DAS MAGNETISCHE PHASENDIAGRAMM DES TERNAEREN MISCHKRISTALLSYSTEMS FERRICHOXIDE-CHROMIC SESQUIOXIDE-ALUMINUM OXIDE. EINE NEUTRONENBEUGUNGSUNTERSUCHUNG]
Wilhelm Scharenberg Jul. 1969 67 p refs In GERMAN
(JUL-611-RX) Avail: CFSTI

Isomorph sesquioxides alpha-ferric oxide and alpha-chromic oxide crystallize in a corundum structure type and form with alpha-aluminum oxide a ternary mixed crystal system; a mixing gap along the series ferric oxide-aluminum oxide closes through addition of about 20 mol percent chromic sesquioxide. The disorder in antiferromagnetic ordering through diadochitic substitution of the magnetic iron-3 +, respectively the chromium-3 + ions by diamagnetic aluminum-3 + ions is investigated by neutron diffraction in order to determine up to which degree of dilution the magnetic ions preserve their antiferromagnetic structure together with their crystal structure. Magnetic phase diagrams included in the ternary system Fe203-Cr203-Al203 contain crystal structure and Neel temperature data. It is found that the magnetic spiral structure of the system remains intact up to an addition of 30 mol percent Al203. The stability of the ordered magnetic phases down to a dilution of the magnetic carrying ions to about 23 mol percent is explained by the transfer-exchange theory for oxygen ions in sesquioxides of corundum structure type. Transl. by G.G.

N70-13533# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INTERDIFFUSION OF TANTALUM AND TUNGSTEN
I. A. Tregubov et al 14 May 1969 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 180, no. 2, 1968 p 423 424

(AD-693835; FTD-HT-23-34-69) Avail: CFSTI CSCL 11/6

To determine the coefficient of interdiffusion between tungsten and tantalum, ground specimens of tungsten and tantalum were held in a vacuum at 2000 degrees C for 48 hours. The diffusion coefficient of tantalum was found to depend on the tungsten content in the interface diffusion layer. The value of the diffusion coefficient of tantalum sharply decreased with increasing tungsten content from 10 to 50 wt. percent, and gradually increased with increasing tungsten content from 60 to 90 wt. percent. The interdiffusion coefficient had a minimum value at a tungsten content of 40-60 wt. percent. TAB

N70-13538# Sandia Corp., Albuquerque, N. Mex.
HEAT VAPORIZATION OF HYDROCARBONS [VERDEAMFUNGSWAERME VON KOHLENWASSERSTOFFEN]
T. E. Morsy 10 Sep. 1969 5 p refs Transl. into ENGLISH from Gas-Wasserfach, (Munich), v. 109, no. 13, Mar. 1968 p 335
(PB-186093T; SC-T-69-1040) Avail: CFSTI CSCL 07D

The heat of vaporization of propane is calculated using the method of Bradford and Thodus, and found to be off from the experimental value by only 0.82%. USGRDR

N70-13539# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY CHEMISTRY AND PHYSICS Progress Report, Jan.–Mar. 1969
5 Sep. 1969 40 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1603) Avail: CFSTI

Developments are reported for a NMR study of the structure of beta-isopropyltropolone complex of uranium and for ThCl4-2BU3PO. Some consequences of including Pu(V) in the scheme of disproportionation of PU(IV) ion in dilute aqueous acid are discussed. Progress in the field of separation chemistry is reported on residue absorption; desorption of Pa-231 adsorbed on glass using isopropanol –HCl; U-234 recovery; Th-229 recovery; and Pb-260 recovery. The Ne-20(d,n)Na-21 reaction was studied from 3 to 6 MeV bombarding energy, and the neutron total cross sections were measured with 2-keV resolution for 0.82- to 1.8-MeV neutrons on Ca-40 and also for energies near 3 MeV on O-16. A one step process for coating beryllium oxide with nickel was developed. NSA

N70-13542# Air Force Cambridge Research Labs., Bedford, Mass.
INTENSITIES IN NITROGEN DISCHARGES AND AFTERGLOWS
O. Oldenberg Jul. 1969 20 p refs *Its* Phys. Sci. Res. Papers No. 390
(AD-694485; AFCRL-69-0311) Avail: CFSTI CSCL 7/4

The auroral afterglow or short-duration afterglow of nitrogen is studied with particular attention to relative intensities in the emission spectrum. It is assumed that in an intense discharge through pure nitrogen, excitation in steps via metastable states occurs. Author (TAB)

N70-13597# Notre Dame Univ., Ind. Radiation Lab.
THESAURUS FOR RADIATION CHEMISTRY
Aug. 1969 55 p Revised
(COO-38-621-Rev) Avail: CFSTI

A list of keywords, developed for indexing papers in radiation chemistry, is presented. The keyword list is followed by a formula list; a few species are indexed by their formulas instead of a name. NSA

N70-13699# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
SULFOXIDES AS SOLVENT EXTRACTION REAGENTS FOR THE ANALYTICAL SEPARATION OF METAL IONS
David Colin Kennedy (Ph.D. Thesis) May 1969 156 p refs
(Contract W-7405-eng-82)
(IS-T-293) Avail: CFSTI

The sulfoxides, a new class of solvent extraction reagents, were evaluated for use in the separation of metal ions. The compounds most extensively studied were di-n-octyl sulfoxide, p-tolyl sulfoxide, and two previously unreported bifunctional sulfoxides; bis(n-octylsulfinyl) methane and bis(n-octylsulfinyl)ethane. Using the rapid, qualitative technique of reversed-phase paper chromatography, the interactions of these sulfoxides with some 50 metal ions were investigated in several acid–ligand systems. All four reagents were studied in 1 to 10 M hydrochloric acid and 1 to 11 M nitric acid. Di-n-octyl sulfoxide and bis(n-octylsulfinyl)methane were also studied in perchloric acid and in ammonium thiocyanate–perchloric acid mixtures. From the results, several analytical separation systems were devised. To demonstrate the utility of these systems, a number of metal combinations were quantitatively separated by batch extraction or by reversed-phase column chromatography. The results showed evidence of four distinct mechanisms of extraction for monofunctional sulfoxides. NSA

N70-13608# United Kingdom Atomic Energy Authority, Harwell (England).
EXPERIMENTS ON THE CHEMISTRY OF ELEMENT 104, KURCHATOVIUM. PART 3: CHEMICAL EQUIPMENT IN A CYCLOTRON BEAM
Yu. T. Chuburkov et al Jan. 1969 35 p refs Transl. into ENGLISH from Russian Report JINR-P7-4021
(NP-Tr-1828; JINR-P7-4021) Avail: CFSTI

Design and operation of chemical instruments installed in the intrinsic cyclotron beam for multicharged ions are described. Physico-chemical conditions used in the studies of chemical properties of Kurchatovium (element 104) (T sub 1/2 = 0.3 sec) are discussed. Author (NSA)

N70-13610# Pennsalt Chemicals Corp., King of Prussia, Pa. Research and Development Dept.
SOME ASPECTS OF THE POLY (METAL PHOSPHINATES) Technical Report
B. P. Block Nov. 1968 25 p refs Presented at the Seventh Philadelphia Sect. Award by the Philadelphia Sect. of the Am. Chem. Soc., 17 Oct. 1968
(Contract NONR-2687(00))
(AD-678324; TR-58) Avail: CFSTI CSCL 7/2

The work on poly (metal phosphinates) at Pennsalt is reviewed with emphasis on zinc, chromium, and titanium phosphinates. Methods of preparation, physical properties, stabilities, and structures are discussed. Author (TAB)

N70-13618# Tennessee Univ., Knoxville. Dept. of Physics.
ELECTRONIC PROPERTIES OF LIQUID WATER Annual Progress Report, 1 Nov. 1968–31 Oct. 1969
Linda R. Painter Jul. 1969 10 p
(Contract AT(40-1)-3861)
(TID-25145; APR-1) Avail: CFSTI

Improved data on the reflectance of distilled water were obtained. These data were taken with sufficient accuracy and precision to allow determination of the optical constants. Additional data were taken on a saturated solution of sodium chloride in distilled water, and these reflectances were analyzed also to reveal the optical constants. Related to the analysis of these data was an extensive study of the polarization of concave diffraction gratings in the vacuum ultraviolet spectral region. Author (NSA)

N70-13649# GCA Corp., Bedford, Mass. GCA Technology Div.
RECOMBINATION RATES OF THERMAL IONS Interim Scientific Report, 1 Oct. 1968–31 Jan. 1969
A. Dalgarno, G. A. Victor, and T. G. Webb Oct. 1968 46 p refs Sponsored by DASA
(Contract AF 19(628)-5662)

(AD-678204; GCA-TR-68-2-A; AFCRL-68-0428; ISR-1) Avail: CFSTI CSCL 7/4

Accurate potential energy curves for the hydrogen molecule were constructed. The potential energy data is used to calculate the cross section of H (−) + H (+) yield H + H using the Landau–Zener theory. A multistate impact parameter theory for the above process is given. Accurate values of the matrix elements needed in the multistate calculations are given. A computer program for solving the multistate equations has been constructed and tested. Author (TAB)

N70-13689# European Atomic Energy Community, Ispra (Italy).
SOME CHEMICAL PROCEDURES FOR THE RADIOLOGICAL MONITORING OF THE ENVIRONMENT
M. de Bortoli and E. Van Der Stricht Oct. 1969 57 p refs
(EUR-4388-e) Avail: CFSTI

This report describes some chemical methods used at the Protection Service by the group which is charged with the survey of environmental radioactivity on the site of the Euratom Ispra Establishment. Particularly, procedures are given for the separation of strontium, cesium and plutonium and for the determination of uranium in some materials like water, atmospheric dust, soil and others in the food chains. Author

N70-13698# Washington Univ., Seattle. Dept. of Chemistry.
NMR STUDIES OF THE HEPTAFLUOROBUTYRIC ACID MICELLE FORMATION Technical Report
Robert E. Bailey and George H. Cady Nov. 1968 10 p refs
(Contract N00014-67-A-0103)
(AD-678200; TR-67) Avail: CFSTI CSCL 7/3

Heptafluorobutyric acid dissolves in water to form micelles. The 19F nmr spectra of solutions covering the concentration range 0.5 to 42 mol per cent show the critical micelle concentration to be 1.6 mol per cent at 26C and 2.5 mol per cent at 0C. Author (TAB)

N70-13734# Iowa State Univ. of Science and Technology, Ames.
INFRARED SPECTRA AND VIBRATIONAL ANALYSES OF SOME DIMERIC TRANSITION METAL PENTAHALIDES
Richard Roman Smardzewski (Ph.D. Thesis) May 1969 128 p refs
(Contract W-7405-eng-82)
(IS-T-292) Avail: CFSTI

The far infrared absorption spectra of a number of dimeric metal (V) halides have been determined. Absorption spectra in the metal-halogen fundamental region of the infrared were obtained for the solid dimeric transition metal pentahalides. The infrared spectra of all of the dimeric metal(V) halides studied were interpreted on the basis of a M sub 2 X sub 10 molecular model of D sub 2h symmetry which possesses two halogen atoms symmetrically bridging two heavy metal atoms. Twelve out of a possible thirteen predicted infrared active fundamentals have been observed for each of the dimeric transition metal pentahalides. Assignments of the vibrational frequencies were established for each of the dimeric metal(V) halides except Nb sub 2 I sub 10 where, because of complicated mode-coupling effects, a frequency assignment and subsequent vibrational analysis was not possible. The infrared spectra of saturated cyclohexane solutions of rhenium(V) chloride also indicated the presence of stable Re sub 2Cl sub 10 units. NSA

N70-13754# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
NEPTUNIUM HEXAFLUORIDE [L'HEXAFLUORURE DE NEPTUNIUM]
Georges Matcheret and Michel Bourgeois Nov. 1969 21 p refs In FRENCH; ENGLISH summary
(CEA-BIB-174) Avail: CFSTI

This compound, discovered by Florin, is generally prepared by the reaction of either a lower fluoride or an oxide of neptunium with fluorine or a halogen fluoride. The molecule has a regular octahedral structure, the neptunium atom being located in the center of an octahedron, the appexes of which are occupied by fluorine atoms. When cold, it appears as an orange crystallised solid. It melts around 54.4°C and boils around 55.2°C under air pressure. Very sensitive to hydrolysis, it is easily reduced by photodecomposition, by bromine and also after reaction with some metallic fluorides (e.g. sodium fluoride, magnesium fluoride). Author (ESRO)

N70-13763# Hamburg Univ. (West Germany). Inst. für Anorganische Chemie.
ALKYNE COMPOUNDS OF ANTIMONY [ALKINYLVERBINDUNGEN DES ANTIMONS]
Heinz Drave (Ph.D. Thesis) 1969 70 p refs In GERMAN
Avail: CFSTI

The chemical synthesis of 5- and 6-valence aryl-alkyne antimony compounds is described. The properties and the molecular structure of the compounds were investigated by means of their infrared and proton magnetic resonance spectra, and by measurements of the electric dipole moments and the electric conductivity. ESRO

N70-13786# Oregon State Univ., Corvallis. Dept. of Chemistry.
STUDY OF GENERALIZED ACID-BASE PHENOMENA IN NON-AQUEOUS IONIZING SOLVENTS WITH RADIOACTIVE TRACERS Final Report
T. H. Norris 28 Jul. 1969 38 p refs
(Contract AT(45-1)-244)
(RLO-244-8) Avail: CFSTI

An extensive investigation of acid–base and related phenomena in nonaqueous ionizing, or supposedly ionizing solvents was conducted. The experimental approach involved primarily techniques employing radioactive tracers. Solvents investigated included liquid sulfur dioxide, sulfur trioxide, thionyl chloride, sulfuryl chloride, acetic acid, acetic anhydride, concentrated sulfuric acid, fused ammonium bisulfate, liquid hydrogen sulfide, and sulfur monochloride. Results indicate that the once well regarded solvent systems concept of acid–base behavior has probably been overemphasized in a number of cases. Rather a broader viewpoint based essentially on the Lewis approach to such phenomena appears more inviting. A brief review of the work done on the project is provided, together with a bibliography of publications. Author (NSA)

N70-13798# California Univ., Livermore. Lawrence Radiation Lab.
HYDROLYSIS OF THORIUM CHLORIDE [HYDROLYSE DU CHLORURE DE THORIUM]
E. Chauvenet and J. Tonnet Jan. 1969 8 p refs Transl. into ENGLISH from Bull. Soc. Chim. Fr., (4) Ser., 47-48, No. 7 (Paris), 1930 p 701–703 Sponsored by AEC
(UCRL-TRANS-10328) Avail: CFSTI

Reactions of anhydrous thorium chloride with water were studied. When a NaOH solution was introduced, the HCl produced in the reactions was neutralized and thorium precipitated in the form of Th(OH)4. The neutralization was monitored by measuring the electric conductivity. The resistance was plotted against the volume of NaOH used and this gave two straight lines intersecting at a point corresponding to 10 ml of NaOH. It was therefore concluded that the reaction proceeds: ThCl4 + 2H2O = ThCl2(OH)2 + 2HCl. Results indicated the presence of a thoryl radical (ThO) in dilute solutions of ThCl4. NSA

N70-13808# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RADIATION INDUCED POLYMERIZATION OF HEXAFLUOROPROPYLENE

A. I. Skobina et al 30 Jan. 1969 8 p refs Transl. into ENGLISH from Simpozium. Radiatsionnaya Khim. Polimerov. Materialy (Moscow), 1966 p 126–128

(AD-693834; FTD-HT-23-851-68) Avail: CFSTI CSCL 7/5

The correlations in the radiation-induced polymerization of hexafluoropropylene cannot be explained on the basis of the ordinary concepts of the development of the process in accordance with the radical or ionic mechanism and require further study. It is possible that the key role in the polymerization of hexafluoropropylene is played by the retardation of the process by the resulting polymerization product and by the products of their radiolysis. Author (TAB)

N70-13828# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftlichen Fakultat.

INVESTIGATION OF N,N,N'-TRIPHENYLUREIDE [ZUR KENNTNIS VON N,N,N'-TRIPHENYLUREIDEN]

Burkhard Behrens (Ph.D. Thesis) 1968 78 p refs In GERMAN Avail: CFSTI

The structure of various metal-triphenylureides is investigated. Some exhibit an acid character, some are of chelate nature, and one (iron (II)-N,N,N'-triphenylureide exhibits a 'high-spin' structure. The preparation of the substances is described and the electrical conductivity, the infrared spectra, and the magnetic properties are measured. ESRO

N70-13838# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.

METHANE: BIBLIOGRAPHY OF THE THERMODYNAMIC AND TRANSPORT PROPERTIES ABOVE 300 K

R. T. Moore, R. H. Harrison, and D. R. Douslin 1969 135 p refs

(PB-186243; AH/B6; BM-14-69) Avail: CFSTI CSCL 07D

The citations in this bibliography pertain to the thermodynamic and transport properties of methane above 300K published before December 1968. Chemical Abstracts was the primary source of references. The subject indexes for Chemical Abstracts were searched through July 1967. The General Physical Chemistry, Equilibrium and Solutions, Thermodynamics and Thermochemistry, and Keyword Index sections of Chemical Abstracts were searched for the period from July 1967 to December 1 1968. Secondary sources included Dissertation Abstracts (1962-1968), Gas Abstracts (1962-1968), U. S. Government Research and Development Reports (1965-1968), many individual journals, and the references given in other bibliographies and individual articles. Author (USGRDR)

N70-13841# Bonneville Power Administration, Portland, Oreg. Chemical Translation Service, Knoxville, Tenn.

THE LIMITS FOR INCREASING THE ELECTROLYSIS RATE BY TEMPERATURE AND ELECTROLYTE CONCENTRATION INCREASES

E. S. Lekht 1969 5 p ref Transl. into ENGLISH from Izvestiya Vysshikh Uchebn. Zavedenii Tsvetnaya Met. (Russia), v. 10, no. 3, 1967 p 31–33 Prepared by Chem. Trans. Serv.

(PB-184935T) Avail: CFSTI CSCL 07D

In most of the industrial hydrometallurgical processes, the consumption of feeding solution is small and does not affect considerably the hydrodynamic conditions of the movement of the electrolyte in the electrolysis cell. Therefore for intensifying the process the temperature and the concentration of metal ions in the solution are increased. Let us investigate now in its general form, the possible limits of the active effect on the diffusion flow by modifying the above mentioned conditions of electrolysis. Author (USGRDR)

N70-13842# Sandia Corp., Albuquerque, N.Mex.

PRESSURE-TEMPERATURE-COMPOSITION DIAGRAM OF THE URANIUM-HYDROGEN SYSTEM [LE DIAGRAMME PRESSION-TEMPERATURE-COMPOSITION DU SYSTEME URANIUM-HYDROGENE]

Ph. Guinet 15 Jul. 1969 23 p refs Transl. into ENGLISH from J. Nucl. Mater (France), no. 25, 1968 p 24–37

(SC-T-69-1030) Avail: CFSTI

The various diagrams: temperature-composition, pressure-composition, and pressure-temperature, in the uranium–hydrogen system, have been drawn, using the most recent data on the solid-gas equilibrium pressure at various temperatures and compositions. These representations bring forth two four phase invariant equilibria; they show that in both isobaric diagrams for pressures higher than 83 atm and isothermal diagrams for temperature higher than 820 C, the domains of the two phases (U sub gamma,H) (a solid solution of hydrogen in gamma-uranium) and uranium hydride join themselves to make a single phase. The conditions for obtaining non-congruent melting of the hydride are deduced, for either constant pressure or constant temperature. Various types of isobaric or isothermal reactions are discussed with respect to their dependence on temperature or pressure. Author (NSA)

N70-13849*# National Physical Lab., New Delhi (India). Radio Propagation Unit.

PHOTOCHEMISTRY OF OZONE

A. P. Mitra 31 May 1969 52 p Sponsored in part by NASA

(NASA-CR-107327; NPL-RPU-S47) Avail: CFSTI CSCL 07D

Photochemical calculations on mesospheric ozone are reviewed for oxygen only, oxygen--hydrogen, and oxygen–hydrogen–nitrogen atmospheres. Effects of vertical eddy transport included in recent works are discussed. The close relation that exists between the ratio n(O)/n(03) and negative ion and negative ion and electron concentrations brings in a new dimension in ozone photochemistry work. A remarkable similarity was observed in previous work between LF phase variations during a solar eclipse and the computed variations in ozone concentrations. Similarities also exist during sunrise and sunset. It thus seems possible to obtain synoptic information on mesospheric ozone from ionospheric parameters. Author

N70-13864# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.

PULSE RADIOLYSIS OF NUCLEIC ACID CONSTITUENTS AND RELATED COMPOUNDS. PART 1: OPTICAL SPECTRUM AND REACTIVITY OF THE 5,6-DIHYDROTHYMINYL FREE RADICAL

L. S. Myers, Jr. and L. M. Theard [1969] 16 p Prepared in cooperation with Gulf Gen. Atomic

(Contract AT(04-1)-GEN-12)

(UCLA-12-749) Avail: CFSTI

Dilute aqueous solutions of dihydrothymine, saturated with N sub 2 O were irradiated at pH 6.8 and 1.0 with sub-microsecond pulses of 10-MeV electrons, and changes in optical absorbance were observed for periods up to 800 mu sec in the wavelength range 300 to 600 nm. A broad absorption band with a maximum at 400 nm was assigned to the 5,6-dihydrothymin-5-yl free radical. This absorption was also observed in reactions of H with thymine, but not in reactions with thymine and subsequent protonation of the anion radical. The dihydrothymin-5-yl radical was stable with respect to intramolecular reactions, and decayed by second order kinetics. The slower decay in acid solutions is consistent with partial protonation of the radical. Author (NSA)

N70-13874# Naval Research Lab., Washington, D.C.
OBSERVATIONS ON THE FORMATION OF ANOMALOUS WATER COLUMNS BY THE CONDENSATION OF VAPOR IN QUARTZ CAPILLARIES [NABLYUDENIYA ZA OBRAZOVANIEM STOLBILKOV ANOMALNOI VODY PRI KONDENSATSII PAROV V KVARTSEVYKH KAPILLYARAKH]
B. V. Deryagin et al 22 Sep. 1969 14 p refs Transl. into ENGLISH from Teor. i Eksperim. Khim. (USSR), v. 4, no. 4, 1968 p 527–532
(AD-693893; NRL-Trans-1178) Avail: CFSTI CSCL 7/2

It is shown that the growth of anomalous water columns in an atmosphere of unsaturated vapors in capillaries proceeds in a kinetic process. The condensation coefficients of water molecules in an anomalous column are much lower than those of ordinary water. The growth rate of anomalous columns depends on the time required to equalize the concentration of the anomalous component within the volume of the column. The diffusion coefficient of the anomalous component in water is almost one order of magnitude lower than the coefficient of self-diffusion of water molecules. The lowering of the diffusion coefficient and the low colatility of the anomalous component may be explained by the large dimensions of its molecules. The assumption is expressed that the molecules of the anomalous component are represented by stable associations of water molecules whose conversion into monomers is sharply delayed. Author (TAB)

N70-13878# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
STUDIES ON SULFUR-CONTAINING CHELATING AGENTS. PART 19: RADIOISOTOPE DILUTION METHOD FOR DETERMINATION OF INORGANIC AND ORGANIC MERCURY BY PAPER CHROMATOGRAPHY
H. Tanaka et al [1969] 8 p refs Transl. into ENGLISH from Bunseki Kagaku (Tokyo), v. 17, 1968 p 1424–1427
(NP-tr-1832) Avail: CFSTI

A new radioisotope dilution method was developed for determination of trace amounts of $HgCl_2$ and phenylmercuric chloride. Penicillamine was used as the chelating agent, and paper chromatography was applied for the separation. A known amount of radioactive mercury and a substoichiometric amount of penicillamine are added to the sample solution, and the resulted solution is chromatographed on filter paper using the mixture of isopropyl alcohol–concentrated NH4OH–water (7:1:2) as the developer. Standard solutions containing radioisotope are treated in exactly the same manner. The separation of the chelate and unreacting Hg compound was satisfactory. The amount of mercury was calculated from measurements of the radioactivity of the spot of the chelate and the standard solution. NSA

N70-13895# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF COMPLEX FORMATION OF HYDROXYSTEARIC ACID WITH BORIC ACID BY INFRARED ABSORPTION SPECTRA
E. I. Azarova et al 13 May 1969 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk Turkm. SSR, Ser. Fiz.-Tekhn., Khim i Geol. Nauk (USSR), no. 2, 1968 p 37–41
(AD-693944; FTD-HT-23-136-69) Avail: CFSTI CSCL 7/4

Investigation of the IR spectra of solid residues of a mixture of sodium salts in the presence of boric acid (1 to 1 ratio) confirmed that the formation of the complex proceeds with splitting off of a proton from the 1,2-OH groups and filling of the boron octet. Author (TAB)

N70-13918# Ballistic Research Labs., Aberdeen Proving Ground, Md. Interior Ballistics Lab.
LABORATORY PROCEDURES FOR THE PURIFICATION OF NITRIC OXIDE AND THE PREPARATION AND PURIFICATION OF NITROGEN DIOXIDE
Leon J. Decker, Jr. and John R. Kelso Aug. 1969 16 p
(AD-693781; BRL-NR-1979) Avail: CFSTI CSCL 7/4

Laboratory procedures involved in the purification of nitric oxide and the preparation and purification of nitrogen dioxide are described in detail. The detection and measurement of residual impurities in the final products are discussed. Author (TAB)

N70-13935# Atomics International, Canoga Park, Calif.
SODIUM ANALYSIS WITH SPARK SOURCE MASS SPECTROMETER
H. Farrar, IV, C. H. Knox, and R. C. Shepard 30 Jun. 1969 45 p refs
(Contract AT(04-3)-701)
(AI-AEC-12835) Avail: CFSTI

A spark source mass spectrometer was applied to the determination of impurities in sodium metal. Modifications to the source housing made it possible to introduce the sodium under vacuum, and to cool the sodium during the analyses with liquid nitrogen. Results show that all elements within a broad mass range are simultaneously detected down to 0.1 ppM levels, with none escaping notice. Comparison of the relative concentrations of impurities between sodium samples can be performed with uncertainties generally of less than 30%, but when more precise absolute concentrations are required, it becomes necessary to analyze specially-prepared standards whose impurity concentrations are known. The isotope dilution technique was used with the spark source mass spectrometer to make repeated determinations of iron in sodium. Author (NSA)

N70-13944# Brookhaven National Lab., Upton, N.Y. Information Div.
A NEW METHOD OF OBTAINING VERY LOW TEMPERATURES
B. S. Neganov Jun. 1969 11 p Transl. into ENGLISH from a Russian reprint
(BNL-TR-276) Avail: CFSTI

The history and advantages of the helium-3—helium-4 dilution refrigeration method are summarized. An apparatus of this type is sketched and areas of application are mentioned briefly. Author (NSA)

N70-13958# Scientific Translation Service, Ann Arbor, Mich. Oak Ridge National Lab., Tenn.
THE PRODUCTION OF ACETYLENE. B2147 PETROCHEMICAL PROCESSES
H. P. Helgesen 1969 121 p refs Transl. into ENGLISH from Norges Tek. Hogskol. Trondheim Selskapet for Ind. Og Tek. Forskning Rept. (Norway) Prepared for Oak Ridge National Lab.
(PB-185720T; ONRL-TR-2205) Avail: CFSTI CSCL 07A

The thermodynamic and reactions kinetics bases for the production of acetylene from hydrocarbons is discussed. In addition, some of the types and principles of processes are described with particular emphasis on more recent processes now being developed, and a superficial comparison is made between ethylene and acetylene as raw materials in the heavy organic chemistry industry. The kinetics of pyrolysis of methane above about 1500C is treated theoretically on the basis of published data. In an industrial process it should be possible to arrive at a yield of 80-90% acetylene from methane. The remaining 10-20% of the carbon will substantially be present as elemental precipitated carbon. Author (USGRDR)

N70-13968# Oak Ridge National Lab., Tenn.
COMPUTER METHODS OF CALCULATING SULFURIC ACID ACTIVITY, SULFATE ION CONCENTRATION, AND ION STRENGTH OF SODIUM SULFATE–SULFURIC ACID SOLUTIONS

W. J. Mc Dowell Aug. 1969 19 p refs
(Contract W-7405-eng-26)
(ORNL-4407) Avail: CFSTI

Four programs for calculating formal and ionic concentrations in mixed sodium sulfate – sulfuric acid solutions are described. Two of the programs calculate the sulfuric acid concentration required in a given total sulfate (H_2SO_4 + Na_2SO_4) concentration to produce a specific sulfuric acid activity and also calculate ionic composition and ionic strength of the resulting solution. The other two programs calculate the ionic composition and strength and sulfuric acid activity of solutions of specified formal composition. The methods of operation of the programs are described, their theoretical basis is outlined, and listings are presented. Author (NSA)

N70-13980# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
COMMENTS ON INTERMOLECULAR FORCES: THERMAL DIFFUSION AND DIFFUSION IN He-Kr AND H_2-Kr
M. J. Hiza and A. G. Duncan Repr. from the Phys. of Fluids, v. 12, no. 7, Jul. 1969 p 1531–1532 refs
(PB-186352; R-523) Avail: CFSTI CSCL 07D

In the paper by Annis, Humphreys, and Mason, deviations from the geometric mean combining rule for the characteristic energy parameter were suggested as the major cause of disagreement between theoretical and experimental diffusion properties. These deviations from the geometric mean rule are also found by evaluating phase equilibrium and volumetric data. A comprehensive study of the phase equilibrium properties of binary systems containing helium, neon, and hydrogen with light hydrocarbons led us to relate the deviations from the geometric mean combining rule to the ionization potentials I of the component species. USGRDR

N70-13981# Redactia Revistelor Agricole, Bucharest (Rumania).
TABLE OF SPECTRAL LINES [TABELE CU LINII SPECTRALE]
Pavlovschi Gheorghe and Tonea Traian 1968 237 p In RUMANIAN; ENGLISH summary
(NP-17990) Avail: CFSTI

The atomic spectral lines are tabulated for wavelengths from 2181.72 to 5025.58 A to aid in spectral quantitative analysis. Basic equations for quantitative analysis are presented. NSA

N70-14000# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NEMATIC SOLVENTS IN HERTZIAN SPECTROSCOPY [SOLVANTS NEMATIQUES EN SPECTROSCOPIE HERTZIENNE]
Roselyne Briere Oct. 1965 28 p refs In FRENCH; ENGLISH summary
(CEA-BIB-167) Avail: CFSTI

This report reviews the use of liquid crystals as solvents in NMR and ESR experiments. When a magnetic field is applied to a nematic mesophase the long axes of the molecules tend to align parallel to the magnetic field. This anisotropic environment is capable of restricting the rotational freedom of a solute and causes its partial alignment with the magnetic field. The viscosity of a nematic mesophase is comparable with that of a normal liquid so that the molecular motion of a solute is sufficiently rapid to average out the intermolecular dipolar coupling. The NMR spectrum of a solute dissolved in such a nematic mesophase shows relatively fine lines which are characteristic of the different intramolecular dipolar interactions. The NMR spectrum of the solvent generally vanishes in the noise. Analysis of the spectra yields information on relative bond lengths, bond angles and signs of spin – spin coupling constants. Recent applications to molecular geometry determination are reported and 47 references are given. Author (ESRO)

N70-14022# Atomic Energy of Canada, Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
A COOLED DEMOUNTABLE SHIELDED HOLLOW CATHODE LAMP AND CATHODES FOR ATOMIC ABSORPTION SPECTROPHOTOMETRY
B. Montford and S. C. Cribbs Aug. 1969 15 p refs
(AECL-3292) Avail: CFSTI

The design, construction and use of a demountable spectral radiation source lamp for atomic absorption spectrophotometry are described. The lamp's chief advantages are its versatility, ease of fabrication and low cost. The hollow cathodes are cooled, demountable and shielded. The preparation of cathodes, operating conditions and evaluation for copper, aluminum, zinc, tin, mercury, lead, ruthenium, molybdenum, and silicon are given. Preparation of tantalum, tungsten and iridium cathodes is also included. Author

N70-14024# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
ULTRA-FAST REACTION TIME IN PURE ICE [CINETIQUE DE REACTIONS ULTRA-RAPIDES DANS LA GLACE PURE]
Marc Dupuis (Ph.D. Thesis, 3 May 1968) Nov. 1969 24 p refs In FRENCH; ENGLISH summary
(CEA-BIB-157) Avail: CFSTI

The kinetics of the reversible ionic reaction, H_2O gives $H(+)$ + $OH(-)$ in pure ice is reviewed and the method of study, the saturation current measurements by Eigen and his colleagues in light and heavy ice and the values of the parameters of the reaction are presented. The theoretical interpretation by Onsager and Dupuis of the experimental value of the effective dielectric constant is given and the recombination process, as well as the mechanism of charge transfer, are discussed. Author (ESRO)

N70-14025# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
A SCHEMATIC REPRESENTATION OF ABLATION PROCESSES [REPRESENTATION SCHEMATIQUE DES PROCESSUS D'ABLATION]
Jacques Jules Nicolas, Samuel Kohn, and Georges Taguet 1969 13 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on Gas-Solid Interactions, Wright-Patterson AFB, Ohio, 13–17 Oct. 1969
(ONERA-TP-734) Avail: CFSTI

With the introduction of simple chemical mechanisms it is possible to explain some characteristic examples of parietal ablation which are of practical interest. In the absence of mechanical erosion one can apply the laws of chemical kinetics and the laws of transfer through the boundary-layer in a simplified form. The experimental results obtained in well specified conditions are in good agreement with those given by the proposed methods for the following materials: pure phenolic resin, phenolic resin reinforced with graphite fibres, phenolic resin reinforced with silica fibres. Author (ESRO)

N70-14042# Scientific Translation Service, Ann Arbor, Mich.
DEPARTMENT OF CHEMISTRY Semiannual Report, Dec. 1967 – May 1968
[1969] 157 p refs Transl. into ENGLISH from the French Report Prepared for Oak Ridge Natl. Lab.
(AEC-TR-7078; CEA-N-1044) Avail: CFSTI

Studies were made on the treatment of medium- and low-level effluents by ion exchange, precipitation, evaporation, and the use of bacteria. Methods are discussed for reprocessing natural U, PuO_2-UO_2, Al-U, and Al-Pu fuels, and thorium dissolution liquors containing U. The effects of tin on the reprocessing of Mosnal fuel, and the oxidation-reduction of plutonium during the reprocessing of Pu-U fuels were studied. Studies are reported on adaption of a pilot plant for reprocessing U-Al, U-Zr, and Pu-Al fuels, inactive operating tests on a pulsed column for reprocessing U-Al alloys, reprocessing of irradiated Th by dissolution and solvent extraction, on-line control of Th concentration by gamma-absorption analyzer,

and analytical control of irradiated Th reprocessing run. The separation of Np from irradiated fuels by solvent extraction using TBP-dodecane-nitric acid was studied. Descriptions are given of tests performed on the vitrification of fission product solutions obtained from reprocessing of low-alloy uranium fuels. NSA

N70-14048# Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY OF THE TRANSURANIUM ELEMENTS
A. V. Baeckmann [1969] 11 p refs Transl. into ENGLISH from Atompraxis (Germany), v. 15, 1969 p 15 - 17
(ORNL-TR-2186) Avail: CFSTI

The essential problems in the chemical analysis of the transuranium elements are discussed and the most important methods of analysis are briefly described. Author (NSA)

N70-14057# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICOCHEMICAL PROPERTIES OF REFRACTORY OXYGEN COMPOUNDS OF RARE EARTH ELEMENTS
K. I. Portnoy et al 17 Apr. 1969 10 p refs Transl. into ENGLISH from Vses. Soveshch. po Khim. Okislov pri Vysokikh Temperaturakh 2nd, Khim. Vysokotemperaturnykh Materialov Tr. (Leningrad), 1967 p 48 - 52
(AD-694792; FTD-HT-23-1458-68) Avail: CFSTI CSCL 11/2

The chromites and monoaluminates of the majority of the rare earth elements were synthesized and certain of their properties were studied, i.e., density, melting temperature, chemical stability, etc. It was shown that all of the synthesized compounds are refractory and that in comparison with the sesquioxides they possess a significant stability to boiling water and to many chemical reagents. Author (TAB)

N70-14064# Scientific Translation Service, Ann Arbor, Mich.
DEVELOPMENT OF A NEW MEASURING METHOD FOR MASS TRANSFER DETERMINATIONS IN SUSPENDED DROPLETS
W. Mensing 1969 110 p refs Transl. into ENGLISH from German report, BMWF-FBK-68-59, Dec. 1968 Sponsored by AEC Prepared for ORNL
(PB-186080T; ORNL-TR-2169; BMWF-FBK-68-59) Avail: CFSTI CSCL 07A

A new method was developed to investigate the mass transfer of solute across the interface of two liquid phases. It was applied to the continuous measurement of the instantaneous exchange rate of the solute between a single freely suspended droplet and the surrounding liquid. The transfering substance is labelled with a beta-emitter. The drop is provided with a liquid scintillator, the scintillations of which are detected by a spectrometer. The influence of surface active agents on mass transfer is discussed. Author (USGRDR)

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-12740*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FIDELITY OF THE PCM TELEMETRY DATA INFORMATION FOR OGO-B-D-E-F, RAE-A, ISIS-A AND OSO-D-E-F SATELLITES
Thomas J. Karras Oct. 1969 19 p refs
(NASA-TM-X-63748; X-563-69-472) Avail: CFSTI CSCL 17B

A fidelity measure has been defined and used to evaluate the present PCM information system from the spacecraft through the central processing facility. This fidelity measure removes a majority of existing "biased-errors" thereby yielding a potentially obtainable quality measure of the experimenters data. Analysis of the bit error probability for all processed satellite passes yields the overall quality of data shipped to the experimenters. The overall average quality of experimenters data for several PCM data satellites was found to have a bit error probability between 1×0.001 and 1×0.000001. The average fidelity for these same spacecrafts was found to have a bit error probability between 1×0.0001 and 1×0.000001. The average fidelity and its standard deviation for most satellite data analyzed are approximately one-half order of magnitude better than the overall average quality and its standard deviation. Author

N70-12789# Mitre Corp., Bedford, Mass.
A GENERALIZED RADAR OUTPUT SIMULATION
J. F. A. Ormsby and S. H. Bickel Jul. 1969 33 p refs
(Contract AF 19(628)-2390)
(AD-693548; ESD-TR-69-183; W-7346) Avail: CFSTI CSCL 17/9

Using the outputs from the simulation of overall body motion related to observations at a complex of earth stations, this report develops a model for generating the scattering matrix and radar output voltages. The general multistatic case is treated using a geometry which simplifies the data gathering and merges conveniently with the motion simulation. The monostatic case is given separate treatment due to certain simplifications possible in this situation. Variations to account for polarization modes, Faraday rotation and noise are also included. Author (TAB)

N70-12846*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
THE STUDY OF SYNCHRONIZATION TECHNIQUES FOR OPTICAL COMMUNICATION SYSTEMS Quarterly Report, 1 Jun. - 1 Oct. 1969
Robert M. Gagliardi 1 Oct. 1969 14 p
(Grant NGR-05-018-104)
(NASA-CR-107123; QR-3) Avail: CFSTI CSCL 17B

Pure synchronization techniques utilizing direct detection, heterodyne detection, and pulsed lasers are investigated to indicate design procedures, assess system performance, and predict future areas of needed study in synthesizing and improving system operation. The true statistics of the photo-electron count at the detector output requires averaging a Poisson density with a certain intensity. The optimal mean square estimator of the signal portion of the received intensity is studied and an attempt is made to derive the information rate of an optical system utilizing photodetectors at the receiver. R.B.

N70-12932*# New Mexico State Univ., Las Cruces. Dept. of Electrical Engineering.
ADVANCED STUDY OF VIDEO SIGNAL PROCESSING IN LOW SIGNAL TO NOISE ENVIRONMENTS Quarterly Progress Report, Jun. - Sep. 1969
Frank Carden and George Davis Sep. 1969 16 p refs
(Grant NGR-32-003-037)
(NASA-CR-107186) Avail: CFSTI CSCL 17B

An FM click model is developed from statistical inferences made on the constituent components of the quadrature noise model. Calculations based on the developed model predicted the occurrence of the "multi-modal" click. This event was subsequently verified experimentally. The mathematical model indicates that there exists a minimum peak phase rate during the click which is exhibited by all click events, and indicates an optimal threshold level for click suppressing FM threshold extending schemes. Author

N70-12968*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETERMINING VISIBILITY INTERVALS BETWEEN AN EARTH TRACKING STATION AND A PLANETARY SATELLITE

P. Argentiero Nov. 1969 25 p refs

(NASA-TM-X-63749; X-551-69-485) Avail: CFSTI CSCL 17B

The problem of finding visibility intervals between an Earth tracking station and a planetary satellite is formulated based on the assumption of an infinite speed of light. A modification to account for the finite speed of light is then added to the formulation. An input–output description and listing of a Fortran computer program which calculates visibility intervals is provided in Appendix 1. The program was used to obtain visibility intervals is provided in Appendix 1. The program was used to obtain visibility intervals between the Goldstone deep space tracking station and a satellite in a typical elliptic orbit around Mars. Author

N70-12972# Systems Research, Honolulu, Hawaii.

ECONOMIC CONSIDERATIONS FOR EDAC CODING ON NAVAL HF COMMUNICATION CHANNELS Final Report, Jul.–Dec. 1968

Denis L. Cogswell May 1969 46 p

(Contract N00123-68-D-0398)

(AD-693312) Avail: CFSTI CSCL 9/4

Naval HF communication systems are not as reliable as desired. Error detection and correction (EDAC) coding can be used in many cases to improve the probability of correct reception of a message while incurring additional cost of equipment and lower data rate or higher bandwidth per message. The measure of reliability or cost of message errors is difficult in the actual communication environment and the value of EDAC coding should not be measured solely by its resultant decrease in average bit error rate. The cost of proposed EDAC coding/decoding equipment and associated maintenance and training costs should be weighed against values resulting from decreased (or less variable) time delays between message transmission and acceptance by the recipient (including possible repeats) and lower probability of undetected errors in the accepted message. Other factors which may contribute positively or negatively to the value of EDAC implementation are flexibilty (ability to use more than one EDAC scheme if conditions warrant), effects of equipment/operator malfunctions, etc. Measuring such factors in dollars is necessary if a representative cost comparison is to be made between various reliability-improvements schemes. A pilot project is recommended to provide performance comparisons between EDAC coding schemes in actual Naval communications environments. Author (TAB)

N70-13124*# Hughes Aircraft Co., Culver City, Calif. Antenna Dept.

STUDY OF APPLICATIONS OF RETRODIRECTIVE AND SELF-ADAPTIVE ELECTROMAGNETIC WAVE PHASE CONTROLS TO A MARS PROBE, PART 2 Final Report, 28 Jan.–31 Dec. 1967

A. T. Villeneuve, J. E. Howard, and N. J. Bershad 31 Dec. 1967 208 p refs

(Contract NAS2-3297)

(NASA-CR-73227; HAC-P68-70) Avail: CFSTI CSCL 17B

Analyses were performed of arrays that obtain self-steering by the use of either phase-locked loops or phase inversion by mixing. The performance of these systems was studied during their assumed reception of multipath signals with various digital modulations. Probabilities of error in reception of these signals were computed. The problem of determining the character of a multipath signal that is scattered by a rough spherical scatterer was also attacked. A vector formulation was used, and integral expressions were obtained for the scattered signal autocorrelation function. The possibility of using millimeter waves to overcome entry blackout was also considered for several Mars entry profiles. Results indicate that for these profiles, signals in the 100-GHz region may not be significantly attenuated. Several self-steering configurations were considered at microwave and millimeter-wave frequencies. Estimates were made of expected effective radiated powers and weights of these systems. Author

N70-13272# Naval Research Lab., Washington, D.C.

THE DETECTION OF NON FLUCTUATING TARGETS IN LOG-NORMAL CLUTTER Final Report

Samuel F. George 4 Oct. 1968 23 p refs

(AD-677926; NRL-6798) Avail: CFSTI CSCL 17/9

Measurements of sea clutter using high-resolution radar indicate that the clutter-cross-section returns follow a log-normal probability density function more closely than the usually assumed Rayleigh law. This report develops the theory for the detection of a steady signal in log-normal clutter by first using a single pulse and then by using the sum of N pulses integrated noncoherently. Plots of the probability density of the envelope of the signal plus clutter show the function to be bimodal, an unexpected result. Curves are presented for the threshold bias, normalized to the median clutter voltage, versus the probability of false alarm for several values of the standard deviation sigma and for various values of N. Author (TAB)

N70-13283# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.

POWER SOURCES FOR LONG ECONOMIC LIFE COMMUNICATIONS EQUIPMENT

Galen R. Frysinger Jul. 1969 19 p

(AD-693847; ECOM-3154) Avail: CFSTI CSCL 10/2

Because of the extended life and operating endurance of new electronic communications equipment, new power sources must be designed and developed which provide no-break operation and optimum costs over these extended operating periods. The concept of a rack-mounted power source as a utility tray component of an integrated shelter is described. Maintainability and life cycle costs are developed for silent static power generation systems in contrast to present engine-generator units. Author (TAB)

N70-13349# Texas Univ., Austin. Antennas and Propagation Lab.

SURVEY OF GASEOUS AND HYDROMETEOR ABSORPTION IN THE ATMOSPHERE IN THE 10 TO 100 GHz FREQUENCY BAND

M. S. Fowler and A. H. La Grone 1 Oct. 1969 121 p refs

(Grants NSF GA-772; NSF GA-11462)

(PB-186223; P-37) Avail: CFSTI CSCL 17B

Spectrum congestion in the lower frequencies will probably force future space communications to the 10-100 GHz band. In this region atmospheric attenuation is severe due to gaseous absorption and hydrometeorological absorption and scattering. Selection of the bands 10-20 GHz and 30-40 GHz minimizes the gaseous absorption, but absorption and scattering by hydrometeors continue to be a factor. The literature available was surveyed to summarize the effects different forms of hydrometeors would have on electromagnetic propagation in this frequency band. Rain is found to be the most critical form of precipitation because of its persistence and because of the severity of its effects. Cloud cover and wet snow or ice may also be important in some circumstances, however. Author (USGRDR)

N70-13350# McGill Univ., Montreal (Quebec). Stormy Weather Group.

TWO-DIMENSIONAL SPECTRA OF PRECIPITATION PATTERNS BY COHERENT OPTICAL ANALYSIS

I. I. Zawadzki and R. R. Rogers Sep. 1969 29 p

(Contract ESSA E22-14-69(N))

(PB-186390; MWT-5) Avail: CFSTI CSCL 17I

This report gives a brief description of the principle of spectrum measurement by coherent optical methods and presents results from an analysis of several radar PPI pictures. Author (USGRDR)

N70-13409# Institute for Defense Analyses, Arlington, Va.
GENERATION AND AIRBORNE DETECTION OF INTERNAL WAVES FROM AN OBJECT MOVING THROUGH A STRATIFIED OCEAN VOLUME 2: SUPPORTING ANALYSES
Walter H. Munk (Calif. Univ., La Jolla), Curtis G. Callan (Harvard Univ., Cambridge), Roger Dashen (Inst. for Advanced Study), James B. Hartle (Calif. Inst. of Tech., Pasadena), Joseph B. Keller et al (New York Univ.) Apr. 1969 128 p refs
(Contract DAHC15-67-C-0011)
(AD-693049; S334-Vol-2) Avail: CFSTI CSCL 17/5

This study deals with fundamentals in the performance of airborne sensors for detecting the wake from the passage of a submarine through stratified water. No attempt has been made to imbed the theoretical results in an operational setting. Author (TAB)

N70-13515# Illinois Univ., Urbana.
PARAMETRIC DESCRIPTION OF A SCAN-DISPLAY SYSTEM
Lawrence A. Dunn, Lakshmi N. Goyal, Bruce H. Mc Cormick, and Val G. Tareski 5 Feb. 1969 71 p refs Presented at Spring Joint Computer Conf., Boston, 1969 Sponsored in part by ARPA Revised
(Contract AT(11-1)-1018)
(COO-1018-1168; CONF-690533-1) Avail: CFSTI

The parametric description of a general purpose Scan/Display System for image digitization and display is presented. Central to the system is the S-M-V Controller which can service either simultaneously or individually three distinct media: film, closed-circuit television and incrementally-driven CRT displays. An adjunct of the system is a Video Communications Net to provide both high and commercial resolution service to remote users. Author (NSA)

N70-13603# Royal Aircraft Establishment, Farnborough (England).
THE 'BEAT 2 RECEIVER': A TWIN CHANNEL OMEGA RECIEVER
R. Couzens Aug. 1968 3 p refs
(RAE-TR-68225) Copyright. Avail: CFSTI

An existing VLF receiver was modified to receive two Omega transmissions. It was used in this modified form to measure the beat phase between the received signals at various distances from the transmitter at night for comparison with theoretical predictions. Author

N70-13617# Stanford Research Inst., Menlo Park, Calif.
A STUDY OF LAND MOBILE SPECTRUM UTILIZATION. PART A: ACQUISITION, ANALYSIS, AND APPLICATION OF SPECTRUM OCCUPANCY DATA
T. I. Dayharsh, T. J. Yung, and W. R. Vincent Jul. 1969 203 p refs
(Contract RC-10056)
(PB-184983) Avail: CFSTI CSCL 17B

The study has provided the first comprehensive data base and data analysis of the occupancy of the land mobile spectrum. This report describes the selection of an optimum spectrum monitoring site in New York and the monitoring performed there; presents an analysis of the band-, service-, and channel-occupancy levels in New York; compares occupancy levels observed for New York, Detroit, and Los Angeles; presents an analysis of single-channel statistics on occupancy, transmission length, number of transmissions, and waiting time; and provides (in an appendix) a computer listing of the peak- and average-occupancy levels, as well as the assignment status, of all the New York land mobile channels. It is concluded that maldistribution exists at every level of the land mobile spectrum structure: channel, band, service, and urban area. The value of acquisition and analysis of spectrum monitoring data for identification of the problems of land mobile spectrum occupancy has been clearly demonstrated. Author (USGRDR)

N70-13701# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
SPACE VEHICLE MULTIBEAM ANTENNA SYSTEM DESIGN [DEFINITION D UN SYSTEME D ANTENNES MULTIFAISCEAUX POUR VEHICULE SPATIAL]
Eugène A. Graham 1969 35 p refs Presented at the IEEE Intern. Conf. on Commun., Boulder, Colo., 9–11 Jun. 1969 Submitted for publication
(ONERA-TP-713) Avail: CFSTI

It is important to be able to explore automatically and at great distances in the universe using sophisticated space vehicles. Radiometric mapping at millimeter wave frequencies represents one of the means by which this can be done. Such a system requires that the antenna sub-system meets certain special and stringent conditions consistent with the radiometric system and with the space exploration and or terminal guidance-and-orientation mission of the space vehicle and, at the same time, take into consideration the limited space available. This paper describes an antenna system designed to meet the above-mentioned stringent requirements: the multi-beam Cassegrain antenna system, which is capable of being flush mounted and contains sufficient elasticity and degrees of freedom (due to its two maneuverable surfaces) to satisfy mission requirements. Author (ESRO)

N70-13793*# TRW Systems Group, Houston, Tex. Electronics Systems Lab.
APOLLO SPACECRAFT SYSTEMS ANALYSIS PROGRAM. TASK E-34E: LM LANDING RADAR PERFORMANCE OVER ROUGH TERRAIN
J. N. Sappington and M. D. Zuteck 14 Nov. 1969 68 p refs
(Contract NAS9-8166)
(NASA-CR-102017; TRW-11176-H397-R0-00) Avail: CFSTI CSCL 17I

The effects of rough terrain on the landing radar performance is evaluated by using PEARL Project flight test data. The PEARL Project was conducted in 1968 at White Sands Missile Range where the landing radar was flown over smooth and rough terrain in both a test helicopter and an aircraft. During each flight test the landing radar provided component velocity and slant range measurements. A cinetheodolite tracking system was also employed to provide a reference standard for each measured landing radar parameter. Vector velocity magnitudes were derived from these radar and cinetheodolite data as an auxiliary parameter. No direct comparison or correlation could be made of data from flights over rough and smooth terrain because sufficient data were not available, some flights were level and some showed variations in their flight paths, and different scale factor modes were used within the same pass of a single flight. It is shown that significant velocity errors as well as range errors can be generated by some terrain types. The terrain studied is sloped such that large range errors are generated, but only small perturbations are experienced in the velocity measurements. Author

N70-13808# Air Force Academy, Colo. Frank J. Seiler Research Lab.
APPLICATIONS OF THE CANONICAL REPRESENTATION TO ESTIMATION AND DETECTION IN COLORED NOISE
Robert A. Geesey and Thomas Kailath (Stanford Univ.) Jun. 1969 43 p refs Presented at Symp. on Computer Process. in Commun., N.Y., 8–10 Apr. 1969
(AD-694482; SRL-69-0010) Avail: CFSTI CSCL 9/4

The representation of a random process as the output of a causal and causally invertible linear system driven by white noise

is called canonical and specifies, quite simply, the whitening filter for the process. Whitening filter techniques replace the observation process, without loss of information, by a white noise process and allow simple formulation of the solutions of estimation and detection problems in terms of the equivalent process obtained by the whitening. Constructive methods based on the solution of a matrix Riccati equation are given for determining the canonical representation of differentiable observation processes which consist of a linear combination of the component process of a finite dimensional Markov process. Implementation of filtering solutions and likelihood ratios for detection are then obtained in a common formulation for a variety of signal with colored noise situations. The approach emphasizes the canonical representation of the observation process while requiring a minimum of attention to models for signal and noise components of the observation. Finite time interval problems for differentiable processes require attention to initial condition random variables and the solutions discussed account for their contribution in a natural way. Author (TAB)

N70-13922# Commissariat à l'Energie Atomique, Grenoble (France) Centre d'Etudes Nucléaires.

SIGNAL PROCESSING IN MAGNETIC RESONANCE [TRAITEMENT DU SIGNAL EN RESONANCE MAGNETIQUE]

Jean-Jacques Dunand Oct. 1969 22 p refs In FRENCH; ENGLISH summary

(CEA-BIB-168) Avail: CFSTI

In a classical magnetic resonance experiment more information can be obtained (i.e. improved signal-to-noise ratio or better resolution) by the matched filter technique. However, for the signal-to-noise ratio, much better results can be obtained by the new measuring methods which make the best use of the measured time interval. A bibliographic review of experiments in both these fields is presented. Author (ESRO)

N70-13925# California Univ., Livermore. Lawrence Radiation Lab.

ON THE RELATIONSHIP OF EXCESS PHASE DISPERSION TO THE ANOMALIES OF BROADBAND SYSTEM COMPENSATION

M. P. Ekstrom 20 Jun. 1969 18 p refs

(URCL-50654) Avail: CFSTI

One of the factors most strongly affecting the compensation of transmission systems is excess phase dispersion. The limitations this dispersion imposes on the system correction are considered from the view of one interested in baseband, pulse fidelity. Frequency domain expressions for system amplitude and phase distortion are presented. Through use of Hilbert transforms, the distortion is so classified as to clearly delineate the circumstances under which it can be corrected. The broadband compensation of TEM coaxial cable is given to illustrate the actual design restrictions encountered in practice. Author (NSA)

N70-14012# RAND Corp., Santa Monica, Calif.

IONOSPHERIC PROBING WITH LONG WAVELENGTH RADIO WAVES

C. M. Crain Sep. 1969 26 p refs Submitted for publication

(AD-693860; P-4185) Avail: CFSTI CSCL 4/1

The paper deals with techniques of ionospheric probing using ground based facilities and frequencies in the region from about 10 Hz to 100 KHz and hence includes the ELF, VLF, and LF portions of the spectrum. Primary emphasis is placed on VLF and LF probing; however for some purposes the ELF portion of the spectrum has promise. Probing techniques at these frequencies involve measuring one or more parameters of a radio signal such as amplitude, phase, transmission time, and polarization as received at locations near (vertical or steep incidence sounding) or at distances of hundreds or thousands kilometers from (oblique sounding) a radiation source. The radiated signal can be provided either by conventional or special purpose pulsed or continuous wave sources or by radiation from lightning strokes. Author (TAB)

N70-14014# RAND Corp., Santa Monica, Calif.

POLARIZATION DISCRIMINATION FOR SATELLITE COMMUNICATIONS

S. J. Dudzinsky, Jr. Sep. 1969 10 p refs

(AD-693925; P-4176) Avail: CFSTI CSCL 17/2.1

It appears feasible for satellite relay systems to provide polarization discrimination of 20 to 30 dB (or more with adaptive antennas) in the antenna main beam. Thus, if the systems are designed to operate with smaller wanted to unwanted signal ratios than those provided by polarization discriminstion, it should be possible to double the effective spectrum available by using it independently on two orthogonal polarizations. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-12707*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

AUTOMATED STATUS REPORTING FOR PUBLICATIONS AT THE JET PROPULSION LABORATORY

R. Van Buren 15 Nov. 1969 34 p

(Contract NAS7-100)

(NASA-CR-107169; JPL-TM-33-430) Avail: CFSTI CSCL 09B

An automated system has been originated to obtain and evaluate progress and status information relating to the production of formal publications. A brief description of these publications, together with an outline of the processes involved in editing, composing, and printing them, is given as a background for a discussion of the system itself. The automated status reporting system produces on a weekly basis a series of computer printouts consisting of lists of active and completed jobs and various statistical and computational recaps. Examples of such printouts are shown, and the computer input requirements and methods are described. Unique or interesting aspects of the computer program are cited, as well as some of the built-in constraints and disadvantages, and the possibility of program expansion is considered. Finally, the use of the program as a management tool is discussed and evaluated. Author

N70-12751# California Univ., Berkeley. Inst. of Library Research.

A STUDY OF THE ORGANIZATION AND SEARCH OF BIBLIOGRAPHIC HOLDINGS RECORDS IN ON LINE COMPUTERS SYSTEMS, PHASE I Final Report, 1 Jul. 1967 - 30 Jun. 1968

Jay L. Cunningham, William P. Schieber, and Ralph M. Shoffner Mar. 1969 281 p refs

(Grant OEG-1-7-071083-5068)

(PB-185655) Avail: CFSTI CSCL 05B

The report presents the results of the initial phase of a research study, the File Organization Project, which focuses upon the on-line maintenance and search of the library's central apparatus of bibliographic control, the catalog holdings record. Author (USGRDR)

N70-12843# Illinois Univ., Urbana. Dept. of Computer Science.

COMPUTER SYSTEMS RESEARCH Annual Report, 1 Sep. 1968 - 31 Aug. 1969

[1969] 41 p refs

(COO-1469-124) Avail: CFSTI

In the software area, accomplishments include completion and distribution of ODESSY, the automatic differential equation package; the success of the new methods for stiff equation on a high altitude chemical reaction problem with Kirkland AFB; the implementation of the master program library tester; and the introduction of the file editing/remote job entry system. In hardware,

the accomplishment highlights are the completion of the Tricolor Cartograph, the automatic coloring machine; the completion of the ORBIT bandwidth compression scheme for line drawings; the completion of phase one of the VISTA bandwidth compression scheme for gray scale information; the completion of the stochastic array computer, RASCEL (supported together with ONR); the completion of the bundle processing machine, BUM (supported together with ONR); the completion of POTENTIOMATRIX, the equipotential line display system (supported together with ONR); and the completion of phase one of the on-line Fourier transform system and demonstration of the feasibility of the principle. Author (NSA)

N70-12868*# Applied Research Lab., Waltham, Mass.
MULTIPAC: A MULTIPLE POOL PROCESSOR AND COMPUTER FOR A SPACECRAFT CENTRAL DATA SYSTEM Final Report
Thomas E. Baker, Gene A. Cummings, and Robert L. South Oct. 1969 23 p refs
(Contract NAS2-3255)
(NASA-CR-73377; SF-7159-1) Avail: CFSTI CSCL 09B

Multipac is a computer designed especially for use as an off-the-shelf central data system for deep space probes. This computer may be repaired during flight through the command and telemetry link by reprogramming around the failed unit. This reprogramming is possible through a computer organization that uses pools of identical modules which the program organizes into one or more computers. The interaction of these modules is dynamically controlled by the program and not hardware. In the event of a failure, new programs are entered which reorganize the central data system. The only effect of such reorganization is to reduce the total processing capability aboard the spacecraft. Consequently, some low priority process may have to be eliminated, but data taking and transmission may continue. Author

N70-12878# California Univ., Livermore. Lawrence Radiation Lab.
LAWRENCE RADIATION LABORATORY OCTOPUS SYSTEM
John G. Fletcher 11 Jun. 1969 10 p Held at the NOC-68 Conf, Nat. Security Agency, Ft. George G. Meade, Md.
(UCRL-71774; Conf-691003-1) Avail: CFSTI

Elements of a computer system used to simulate nuclear explosions are described. The significant aspects of the system, named OCTOPUS, are a central file facility and teletype machines, any of which has the capability of contacting any one of the peripheral machines. Author (NSA)

N70-12885# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
AN OVERVIEW OF COMPUTER AIDED CIRCUIT DESIGN
Franklin F. Kuo and Waldo G. Magnuson, Jr. Jul. 1969 10 p refs
(Contract F44620-69-C-0030)
(AD-692891; A69-2; AFOSR-69-2067TR) Avail: CFSTI CSCL 9/5

Historically, the evolutionary process in computer-aided design began with the coding and evaluation of simple formulas in physical design. As computers became faster--with the coming of second generation machines such as the IBM 7090--more complex problems, such as logic circuit simulation and electronic circuit analysis, became feasible with computers. Successive design by trial and error methods, however, was not generally practiced, due to the excessive turn-around times associated with batch processing. Since time-sharing in computers has become a practical reality, we are now able to treat problems that are too complex to be put entirely on the computer. These problems involve the successive testing of hypothetical solutions until a satisfactory design is achieved. In the real-time dialogue between man and machine, the man controls the decision processes, while the machine does the step-by-step solutions. Author (TAB)

N70-12901# British Steel Corp., London (England). Midland Group.
POINT TRANSFORMATION BETWEEN INCLINED AXES AND RECTANGULAR AXES (PRG 61)
1969 4 p
(PB-186168; M/Z.065/S.5801/-169/C) Avail: CFSTI CSCL 09B

A machine order program has been written in ALGOL for the Elliott 803 computer to transform geometrical points in three dimensions from inclined axes to rectangular axes. The inverse transformation is also available within the program. The derivation of the transformation, details of the preparation of the data and operating instructions are given. Author (USGRDR)

N70-12907# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
FLUXPLT: A FORTRAN 4 PROGRAM TO PLOT ISOFLUX LINES BASED ON THE SCALAR FLUX CALCULATED BY THE DOT PROGRAM
Larry L. Moran and Richard G. Soltesz 21 Jun. 1968 94 p refs
(WANL-TME-1813) Avail: CFSTI

FLUXPLT is a FORTRAN 4 program which rapidly and economically produces a plot of isoflux lines in the R-Z coordinate system based on the scalar flux calculated by the DOT two-dimensional discrete-ordinates transport program. The calculation methods used to transform the scalar flux into final responses are described. The level of flux to be plotted and the format of the plot are controlled by the user. Author (NSA)

N70-12916# British Steel Corp., London (England). Midland Group.
ELLIOTT 803 STATISTICAL PROGRAMS. PART 10: TWO FACTOR NESTED ANALYSIS OF VARIANCE (PRS 23)
L. N. Tomlinson 1969 5 p
(PB-186169; M(U)PZ004/S5217/9/C-Pt-10) Avail: CFSTI CSCL 09B

This is a further program in the present series of statistical programs. The program outputs the analysis of variance table followed by variance of the batches, samples and subsamples. Also tables of sample means and batch means are output. Included in the report are the operating instructions and examples of input and output. This program can also be used for single factor analysis of variance provided all groups are of equal size. Author (USGRDR)

N70-12929*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
DSS SUBSYSTEM IMPLEMENTATION BY TIME-SHARED COMPUTER
Robert C. Tausworthe 1 Oct. 1969 88 p
(Contract NAS7-100)
(NASA-CR-107200; JPL-TM-33-420) Avail: CFSTI CSCL 09B

A rationale and method are presented for effecting the synthesis of multiple DSIF real-time functions in a single computer. Included are the management-supervisory, as well as engineering disciplinary roles and interfaces required to allow independent, noninterfering subfunction development and subsystem operation. Author

N70-12956# Oak Ridge National Lab., Tenn.
AMPLIFICATION OF SELECTED PORTIONS OF THE 05R MONTE CARLO CODE USER'S MANUAL
D. C. Irving, V. R. Cain, and R. M. Freestone, Jr. 29 May 1969 117 p
(ORNL-TM-2601) Avail: CFSTI

A miscellaneous collection of material useful in using, modifying, and understanding the 05R code is presented. It is roughly grouped into three sections. The first section presents logic flowcharts (supplementing the FORTRAN flowcharts of the original

report) for the important subroutines of 05R. The second section presents logic flowcharts for XSECT, the cross-section handling program. The final section is comprised of logic flowcharts and other material describing the operation of the general geometry package, GEOM. Author (NSA)

N70-13003# Science Research Council, London (England). Rutherford High Energy Lab.

FURTHER DEVELOPMENT OF THE MAGNETOSTATIC COMPUTER PROGRAMME TRIM AT THE RUTHERFORD LABORATORY

N. J. Diserens 1969 13 p refs

(RHEL/R-171) Avail: HMSO: 7s; BIS $1.40

TRIM is a computer program, developed for the solution of two dimensional magnetic problems in systems of coils with iron. Further work on this program, with particular reference to cylindrical geometry, is described. A series of simple analytic tests was used to pinpoint sources of error in the program and to check the improved version. Tests against actual magnets showed that rotationally symmetric problems can now be handled with the same confidence as those of plane geometry. Among additional facilities incorporated in the program is that of being able to specify a steady field external to a model; this makes possible the investigation of problems of screening equipment from external fields. Alternatively, by regarding a magnetic system as a dipole, and setting the boundary potentials accordingly, it is possible to determine the stray field external to a yoke or screen. Author (NSA)

N70-13055# Brookhaven National Lab., Upton, N.Y.

NOAH

Gerald S. Lellouche Jan. 1969 19 p Sponsored by AEC

(BNL-50157) Avail: CFSTI

NOAH is a code in the NOMURK dynamics system which solves the one-energy group, one-dimensional space-time diffusion equation accounting for temperature and xenon feedback. Author (NSA)

N70-13126# British Steel Corp., London (England). Midland Group.

ELLIOTT 803 STATISTICAL PROGRAMS. PART 4: A COMPUTER PROGRAM TO REMOVE SETS OF DATA FROM REGRESSION DATA TAPES (PRS 17)

R. L. Middleton 1969 2 p

(PB-186296; PZ-004/S.5217/5/C) Avail: CFSTI CSCL 09B

The program described in the report has been developed as a natural extension of Part 1 of this series of general statistical programs 'A General Program for Multiple Regression Analysis'. It has been written to remove sets of data from regression data tapes which are not required from analysis by PRS 11. However, although such a similar facility is already in existence in PRS 11, this program has been written to cater for the more specific task of splitting a regression data tape up into several groups when it is found necessary for regressions analysis to be carried out on each group separately rather than on a pooled set of data. Operating instructions together with details of preparation of steering and data tapes are also given in the report. Author (USGRDR)

N70-13128# Joint Publications Research Service, Washington, D.C.

TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 77

15 Oct. 1969 98 p ref Transl. into ENGLISH from East German and Polish publications

(JPRS-49065) Avail: CFSTI

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N70-13129# Joint Publications Research Service, Washington, D.C.

CURRENT STATUS OF COMPUTER TECHNOLOGY ANALYZED

Tadeusz Jacewicz *In its* Transl. on Eastern Europe Sci. Affairs, No. 77 15 Oct. 1969 p 4–8 Transl. into ENGLISH from Maszyny Mat. (Warsaw), No. 7–8, 1969 p 1–2 (See N70-13128 03-08) Avail: CFSTI

The development of the electronic computer industry in Poland – its present status, rate of growth, and future prospects—is outlined. Despite a strong increase in data processing activities during 1968, it is felt that computer engineering neither corresponds with Polish needs nor with the country's capability to produce the required machinery. The economic and technological requirements for developing third generation systems to replace the second generation equipment presently being utilized are briefly identified. Finally, future directions in the data processing industry and computer application to a number of industrial, administrative, and scientific activities are postulated. A.C.R.

N70-13130# Joint Publications Research Service, Washington, D.C.

COMPUTER TECHNOLOGY ADVANCES IN GDANSK

Jan Zydowo *In its* Transl. on Eastern Europe Sci. Affairs, No. 77 15 Oct. 1969 p 9–17 Transl. into ENGLISH from Maszyny Mat. (Warsaw), No. 7–8, 1969 p 3–5 (See N70-13128 03-08) Avail: CFSTI

Advances in computer technology in the Gdansk region of Poland are discussed, and an evaluation is made of the number and adequacy of existing data processing services to various enterprises. The movement toward mechanization in the area began in 1959 in the shipbuilding industry and expanded to other maritime activities primarily under the direction of a government-organized coordination team, aided by research at the Gdansk Polytechnical Institute. Tabulated data are presented showing the number of enterprises currently using mechanized procedures and equipment; it is emphasized that only one of the operational computers is fully suitable for processing administrative and control data. The remaining machines can only be operated for scientific and technical calculations and for teaching purposes. Production plans are presently being formulated through 1985 to insure harmonious growth and provision of adequate services to all economic activities of the region. A.C.R.

N70-13131# Joint Publications Research Service, Washington D.C.

AUTOMATIC DATA PROCESSING SPECIALISTS TRAINED

Andrzej Szymborski *In its* Transl. on Eastern Europe Sci. Affairs

No. 77 15 Oct. 1969 p 18–20 Transl. into ENGLISH from Maszyny Mat. (Warsaw), No. 7–8, 1969 p 6–7 (See N70-13128 03-08)
Avail: CFSTI

The program to prepare specialists to operate an ICT 1904 digital computer installed in 1967 at the Electronic Computer Technology Institute at Gdynia, Poland is briefly described. The first lecturers were British experts, who offered short basic instruction in the PLAN and COBOL languages. A more extensive course was later given to a select group of operators and analysists at the British computing center to familiarize them with the particular hardware configuration and to extend knowledge of teaching procedures and programming techniques. These basic instruction programs enabled organization of in-house, Polish language courses in PLAN, COBOL, and FORTRAN to develop the capabilities of more workers and also allowed the graduates to undertake independent work on more complex problems. A.C.R.

N70-13132# Joint Publications Research Service, Washington, D.C.
COMPUTER TECHNOLOGY APPLIED TO POLISH PORTS
Jerzy Malicki and Stefan Rakowski *In its* Transl. on Eastern European Sci. Affairs, No. 77 15 Oct. 1969 p 21–40 Transl. into ENGLISH from Maszyny Mat. (Warsaw), No. 7–8, 1969 p 8–13 (See N70-13128 03-08)
Avail: CFSTI

A concept for utilizing computer technology for controlling seaport operations is described. Information sources for an integrated processing system and techniques for utilizing data to control cargo transport are emphasized. Examples are cited of presently used subsystems for wage computation, automation of selected aspects of port operation, and management activities. Possibilities and tests for applying mathematical methods to modeling work in seaports are suggested and problems involved in their implementation mentioned. It is anticipated that total cargo transfer through Polish seaports will increase 100% by 1975, making efficient operations mandatory and creating an increased requirement for mechanized procedures. A.C.R.

N70-13133# Joint Publications Research Service, Washington, D.C.
COMPUTER TECHNOLOGY APPLIED TO POLISH SHIPPING
Boguslaw Guzlak *In its* Transl. on Eastern European Sci. Affairs, No. 77 15 Oct. 1969 p 41–54 Transl. into ENGLISH from Maszyny Mat. (Warsaw), no. 7–8, 1969 p 14–18 (See N70-13128 03-08)
Avail: CFSTI

An automated system for operating Polish shipping companies is proposed. The first stage includes automation of personnel and financial records, as well as use of mathematical methods to optimize economic decisions. The second stage involves work on the complex mechanization of planning, record-keeping, and management activities of a shipping company and the formation of a fleet exploitation control center equipped with large computer facilities. Several systems in the design or operational phase are described for controlling activities and maintaining necessary labor records. It is emphasized that the maritime industry is one of the major Polish economic units to implement long-term computerized systems, chiefly a result of cooperation between the various enterprises and the Electronic Computer Technology Institute at Gdynia. A.C.R.

N70-13134# Joint Publications Research Service, Washington, D.C.
ICT SERIES 1900 COMPUTER USED IN GDYNIA
Roman Jelinski and Jaroslaw Rucki *In its* Transl. on Eastern European Sci. Affairs, No. 77 15 Oct. 1969 p 55–62 Transl. into ENGLISH from Maszyny Mat. (Warsaw), no. 7–8, 1969 p 18–20 (See N70-13128 03-08)
Avail: CFSTI

A general description is given of the programming procedures required for full operation of the ICT 1904 digital computer in use at the computing center in Gdynia. Various systems programs for organizing and controlling the computer's operation are treated, along with compiler and utility routines and a specialized language for matrix computations. Applications programs for use with special sets of data are divided into the following basic types: (1) statistical and optimalizing programs; (2) management and production planning routines; (3) specific technical and engineering programs; and (4) routines for accumulating and selecting information for particular operations. Finally, a brief evaluation of the programming system at its current stage of implementation is given. A.C.R.

N70-13135# Joint Publications Research Service, Washington, D.C.
STRUCTURE OF COMPUTER CENTER IN GDYNIA DESCRIBED
Tadeusz Mazurkiewicz *In its* Transl. on Eastern European Sci. Affairs,No. 77 15 Oct. 1969 p 63–82 Transl. into ENGLISH from Maszyny Mat. (Warsaw), no. 7–8, 1969 p 21–26 (See N70-13128 03-08)
Avail: CFSTI

Equipment, tasks, activity programs, and organization of the computer center in Gdynia, Poland are described. The 16K digital computer has 23 channels and multiprogramming capability. The system is composed of four main programs, two subprograms, and a control monitor. The function of the center is to meet current and anticipated computing needs of various organizations as well as those of economic and administrative units in the Gdansk region. Cooperative operations with the maritime activity in this area are a specific feature of the institute. A.C.R.

N70-13136# Joint Publications Research Service, Washington, D.C.
INFORMATION RETRIEVAL SYSTEM DEVELOPED
Jan Wierzbowski *In its* Transl. on Eastern European Sci. Affairs, No. 77 15 Oct. 1969 p 83–94 ref Transl. into ENGLISH from Maszyny Mat. (Warsaw), no. 7–8, 1969 p 30–33 (See N70-13128 03-08)
Avail: CFSTI

Design, operation, and application of the IBIS bibliographic data retrieval system for the ZAM 41 computer are discussed. The system, developed at the Warsaw Computer Institute, retrieves bibliographic entries according to specified criteria; the necessary data are constantly being prepared by a complementary system in operation at the same facility. An auxiliary function of maintaining updated records is included to ensure the current status of the system. Queries are processed according to various criteria, including division and subdivision symbols, year of publication, language, and type of publication, as well as texts mentioned in the description. Compatibility with other retrieval systems is provided as long as the record formats are identical. A.C.R.

N70-13158# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYTICAL METHODS AND ACOUSTIC DATA REDUCTION FOR THE STUDY OF AIRPLANE ENGINE NOISE [METHODES DE DEPOUILLEMENT ET DE TRAITEMENT DE L'INFORMATION ACOUSTIQUE POUR L'ETUDE DU BRUIT DES MOTEURS D'AVION]
Jacques Hay *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 14 p refs In FRENCH (See N70-13137 03-02)
Avail: CFSTI

Acoustic signal processing and real time analysis techniques are adapted to airplane engine noise spectral data. Automatization

and speeding up of certain operations are described, as well as the sequencing of signals and circuit design of the computer. Calculations made by automatic processing reduced the data analysis by five to six times. Transl. by M.H.E.

N70-13177# British Steel Corp., London (England). Midland Group.
ELLIOT 803 STATISTICAL PROGRAMS. PART 9: ANALYSIS OF VARIANCE, LATIN SQUARES (PRS 22)
L. N. Tomlinson 1969 4 p refs
(PB-186170; M(U)PZ004/S5217/8/C) Avail: CFSTI CSCL 09B

The program is an addition to the present series of statistical programs. The program produces an analysis of variance table and also a table of mean values. Included in the report are the operating instructions and a sample of input and output. Author (USGRDR)

N70-13179# Michigan Univ., Ann Arbor.
CONCOMP: RESEARCH IN CONVERSATIONAL USE OF COMPUTERS Semiannual Progress Report, 1 Jul. 31 Dec. 1968
F. H. Westervelt Aug. 1969 73 p
(Contract DA-49-083-OSA-3050)
(AD-692956) Avail: CFSTI CSCL 9/2

The report describes the research results of the Concomp Project Research in the Conversational Use of Computers, for the period 1 July to December 1968. Topics include modifications to the IBM 360/67 central computing facility expansions of the Data Concentrator, the programmable data communications interface to the 360/67 designed and constructed at the University of Michigan, implementation of the Touch-Tone telephone as a general terminal using the audio response unit further developments of MAD/1, the development of display file routines for use in communicating between the DEC 338 and the IBM 360/67 and the development of a General Network Service System ganeses, to provide a framework, both theoretical and practical, within which various network types—queueing networks, electrical networks, flow networks, etc.—may be described and analyzed graphically in a conversational manner. Author (TAB)

N70-13187# Illinois Univ., Urbana. Dept. of Computer Science.
DEPARTMENT OF COMPUTER SCIENCE, PART 1 Technical Progress Report, 1 Oct. 1968 31 Sep. 1969
23 Jul. 1969 65 p refs
(Contract AT(11-1)-1018)
(COO-1018-1187; Rept-342) Avail: CFSTI

Development of the Illiac III computer system is described in terms of 14 constituent subsystems of processors, units, and peripheral device groups. Software developments including the operating system and translators are discussed. Also, accomplishments in pattern recognition theory are presented; and publications, papers, talks, and reports are listed. NSA

N70-13193# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
MANAGEMENT OF A PROGRAMMING PROJECT: AN APPROACH
R. A. Tannert 15 Oct. 1969 37 p
(Contract W-7405-eng-26)
(PB-186345; Y-DE-13) Avail: CFSTI CSCL 09B

It is the intent of the paper to describe an approach to the management and control of a programming project that attempts to tie together many of the various activities of a project from the original systems analysis and design to the final documentation and implementation. Author (USGRDR)

N70-13194# British Steel Corp., London (England). Midland Group.
GENERAL EDITING OF DATA-LOGGER OUTPUT
A. Austwick 1969 3 p
(PB-186174; M/PZ)46/S.5832/-/69/C) Avail: CFSTI CSCL 09B

An Elliott 803 computer program has been written to extract certain groups of data from punched tape output from a data-logger, to test these data for errors, and to output the selected data with any error indications on to a new punched tape. Author (USGRDR)

N70-13199# British Steel Corp., London (England). Midland Group.
ELLIOTT 803 STATISTICAL PROGRAMS. PART 1: A GENERAL PROGRAM FOR MULTIPLE REGRESSION ANALYSIS (PRS 11)
Robin E. Day 1969 19 p refs
(PB-186291; PZ.004/S.5217/C) Avail: CFSTI CSCL 09B

A comprehensive multiple regression program has been developed for the Elliott 803 digital computer. The program has been written with full flexibility in the modes of operation. It is Part 1 of a family of statistical programs, which should prove to be a useful tool for the statistician in analytical work. Author (USGRDR)

N70-13238*# Maryland Univ., College Park. Computer Science Center.
KEY WORD IN CONTEXT INDEX AND BIBLIOGRAPHY ON COMPUTER SYSTEMS EVALUATION TECHNIQUES
Sarah Crooke and Jack Minker Dec. 1969 52 p refs
(Grant NGR-21-002-197)
(NASA-CR-107214; TR-69-100) Avail: CFSTI CSCL 09B

The documents selected contain information pertinent to the areas of system evaluation, simulation languages, mathematical modeling, and simulation techniques applicable to time sharing, multiprocessing, and multiprogramming data processing systems. Author

N70-13243# RAND Corp., Santa Monica, Calif.
AN INTERACTIVE GRAPHIC SYSTEM FOR CURVE HITTING AND EDITING
A. S. Priver Sep. 1969 87 p
(AD-693920; P-3766) Avail: CFSTI CSCL 9/2

The system described here allows a user to enter a curve into an IBM 360/40 computer via a RAND Tablet, and interactively to specify various ways of fitting, editing and displaying the curve on an IBM 2250 scope. The system consists of a number of interconnected pages on the 2250, by which the user can: (1) Enter curves by tracing them onto the Tablet. (2) Least-squares smooth the data points in various ways. (3) Consider various subsets of the data points. (4) Add, move, or delete individual data points via the Tablet stylus. (5) Fit data points by splines or least-squares polynomials of specified degree. Space curves are currently handled as parameterized pairs. (6) Comparatively display spline and least-squares fits. (7) Punch cards with data points or coefficients. Control is exclusively via Tablet stylus, using software-sensitized areas for pointing and a set of character recognition programs for alphanumeric inputs. Author (TAB)

N70-13268# British Steel Corp., London (England). Midland Group.
TO MOVE THE GRAPH PLOTTER PEN FROM ITS CURRENT POSITION TO A POINT WITH SPECIFIED CO-ORDINATES (X,Y) IN THE BEST APPROXIMATION TO A STRAIGHT LINE (PRP 3)
G. W. Rigby 1969 5 p
(PB-185925; PZ.036/S.5705/1/69/C) Avail: CFSTI CSCL 09B

A machine code subroutine, written for the 803, to move the on-line, incremental graph plotter pen in an approximation to a straight line is described in this report. An autocode version of the subroutine is also available. Details of the method and use of the subroutine are given. Author (USGRDR)

N70-13290# British Steel Corp., London (England). Midland Group.
TO DRAW A FLOATING POINT NUMBER ON THE GRAPH PLOTTER (PRP 2)
G. W. Rigby 1969 3 p
(PB-185926; PZ-036/S.5705/-/69/C) Avail: CFSTI CSCL 09B

It is necessary, for example in the labelling of axes etc., to be able to output to the graph plotter the contents of a store location the value of which has been calculated by a user program. A subroutine has been written for the Elliott 803 in machine code, and is described in the report. A version for use in autocode programs has also been written. Author (USGRDR)

N70-13314# British Steel Corp., London (England). Midland Group.
PROGRAMS FOR CALCULATING AND PLOTTING ATOMIC PROJECTIONS (PRX17/PRX 17A)
J. C. Minor 1969 13 p
(PB-185924; M/PZ042/S.5767/-/69/C) Avail: CFSTI CSCL 20B

The program calculates co-ordinates of atoms from general values; projects these coordinates together with the corners of the unit cell onto a specified plane, and plots a graph of the atoms projections, indicating the atom positions by circles and corner positions by crosses. Author (USGRDR)

N70-13317# Illinois Univ., Urbana. Dept. of Computer Science.
THE HARDWARE DESIGN OF A COGNITIVE MODEL DEMONSTRATOR
Tien-Ren Richard Cheng (M.S. Thesis) Aug. 1969 50 p refs
(Contract AT(11-1)-1469)
(PB-186061; COO-1469-0143; Rept-345) Avail: CFSTI CSCL 09B

The study is concerned with the development and design of the hardware portion of a hypothetical cognition system. Completely satisfactory mechanical solution of these interhuman information transfer problems requires mechanical devices which form a representation of meaning of the communication, that is, a more or less rudimentary understanding of a communication. The hypothetical cognitive system is to be able to perceive (without a TV camera or other projection type of viewer) a scene, interpret the implicit meaning and react properly. In other words, the system is able to detect, discriminate, search file, compare the perceived information with the memorized information and decide how to react. USGRDR

N70-13343# Illinois Univ., Urbana. Dept. of Computer Science.
DESIGN OF A DISPLAY PROCESSING UNIT IN A MULTI-TERMINAL ENVIRONMENT
Raphael Hostovsky (M.S. Thesis) 30 Jul. 1969 59 p refs
(Contract AT(11-1)-1469)
(PB-186-055, Rept-343, COO-1469-0142) Avail: CFSTI CSCL 09B

The design of a general purpose graphic interactive modeling and simulation system is now being conducted. The display terminal and a central computer are the basic components of the system. Often systems have displays which are tied directly to central registers of the parent computer. The problem with this scheme is that the processor is tied up in generating displays. The solution presented in the paper is the introduction of an intermediate system that will generate and maintain the display at each terminal. The central processor has to generate the picture information only once and pass it to the intermediate system. The system includes a display processing unit (DPU) and a memory. The DPU interprets the picture information and generates sequences of efficient display commands which are stored in the memory. This information is used to refresh a displayed image. USGRDR

N70-13352# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
COMPUTER PROGRAMS FOR SOME EDDY CURRENT PROBLEMS
J. W. Luquire, W. E. Deeds, C. V. Dodd, and W. G. Spoeri Aug. 1969 268 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2501) Avail: CFSTI

Computer programs for solving some eddy-current problems frequently encountered in nondestructive testing are described. Operating instructions and examples are given for each program. These programs are written in BASIC language and may be used on a time-sharing computer. Various eddy-current tests can be quickly and accurately designed by utilizing these programs. Author (NSA)

N70-13411# RAND Corp., Santa Monica.
SOVIET CYBERNETICS REVIEW, VOLUME 3, NO. 6
Wade B. Holland, ed. Jun. 1969 129 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-692697; RM-6000/6-PR-Vol-3-No-6) Avail: CFSTI CSCL 9/2

The June issue initiates a new title for the former Soviet Cybernetics: Recent News Items. One article gives the first concrete evidence of a new direction in Soviet computers toward third-generation machines that are program-compatible with the IBM System 360; the M-1000, -2000, and -3000 are the first being developed. Other hardware discussed are the Ural-14, Razdan-3, BESM-4, Ruta-110, Minsk-22, -23, and -32 computers and the Robotron-300 high-speed data processing complex. One article concludes that a multimachine operating mode promises more efficiency than does multiprogramming. Several articles stress the importance of fitting computers for national economic planning and automated control systems. An article on modeling artificial intelligence is included. TAB

N70-13446# California Univ., Livermore. Lawrence Radiation Lab.
PRIORITY STRUCTURE FOR MULTIACCESS MEMORY SYSTEMS
James Carver Hill (Ph.D. Thesis) Aug. 1969 90 p refs
Sponsored by AEC
(UCRL-50701) Avail: CFSTI

Computer system speed has brought about a continuing increase in the parallelism of these systems. The number of processors and other devices which are required to access the same core-memory has increased markedly. That portion of such multiaccess systems which allocates the memory accesses available at a given instant of time among the devices then requesting access to memory is denominated the priority structure. Three attributes are desirable in a priority structure: 1. It should service all requesting devices within the limits of their patience. 2. All accesses available from the core-memory should be made available to devices. 3. It should be modularly constructed and reconfigurable so that no single component is absolutely necessary for system operation. A limited-latency is developed which does exhibit all of the desired characteristics. Author (NSA)

N70-13481*# Maryland Univ., College Park. Computer Science Center.
ANALYSIS OF DATA PROCESSING SYSTEMS
Jack Minker, Sarah Crooke, and James Yeh Dec. 1969 108 p refs
(Grant NGR-21-002-197)
(NASA-CR-107265; TR-69-99) Avail: CFSTI CSCL 09B

Two major tasks were undertaken during the study. These were in the areas of problem definition and model development. The major function of problem definition was to characterize

multiprogramming, multiprocessing computer systems in terms of hardware, software, personnel, and operating environment so that such systems or portions of them could be evaluated using analytic and simulation techniques. In the process, consideration was given to tools that could be developed and used to gather statistical data so as to permit practical measurement of the research results. In the area of model development, a portion or function of a multi-computer system was defined and analyzed. Author

N70-13508# Illinois Univ., Urbana. Dept. of Computer Science.
AN INTERACTIVE GRAPHIC MODELING SYSTEM
C. W. Gear Apr. 1969 51 p refs
(Contract AT(11-1)-1469)
(PB-184723; COO-1469-0115; Rept-318) Avail: CFSTI CSCL 09B

The report outlines the design of a general purpose graphic interactive modeling and simulation system in which the user can define the primitives of the system in the first stage, and then use them to model his problem in the second. The use of graphics during all stages of system use is stressed as an important part of the interactive quality of the system, although it is certainly true that with suitable input and output conventions, the system could be operated from a typewriter terminal or through batch. TAB

N70-13523# Idaho Nuclear Corp., Idaho Falls.
DATMON: A PDP-9 COMPUTER PROGRAM FOR THE SIMULTANEOUS ACQUISITION OF DATA FROM ONE NEUTRON TIME-OF-FLIGHT SPECTROMETER AND ONE NEUTRON TRIPLE-AXIS CRYSTAL SPECTROMETER. A USER'S MANUAL
W. R. Myers Jul. 1969 128 p
(Contract AT(10-1)-1230)
(IN-1287) Avail: CFSTI

The time-of-flight and triple-axis Data Monitor is a set of interacting PDP-9 computer programs which will control the simultaneous acquisition of data from one time-of-flight neutron spectrometer and one neutron triple axis crystal spectrometer. This report is primarily intended to be a user's manual for the Data Monitor; although a few pages are devoted to programming philosophy and discussion of program operation, the emphasis is on the 50 keyboard commands available to the experimenter for the control of his experiment. Author (NSA)

N70-13596# Sandia Corp., Albuquerque, N. Mex. Computer-Aided Design Systems Div.
PROGRAM WINNOW: USER'S MANUAL
Lewis A. Faw Sep. 1969 55 p
(SC-M-69-401A-Pt-1) Avail: CFSTI

Program WINNOW for editing, checking, and correcting data which represents a printed circuit board is described. It edits input, checks all circuitry for specified clearances and makes corrections where necessary for good connections of circuitry elements. The input to WINNOW is digitized data prepared for the Gerber NC drafting machine. The output from WINNOW consists of: (1) corrected data for the Gerber (magnetic tape or cards), (2) a drawing which relates x and y coordinate data to drill holes and terminals (lands), and (3) an S-C 4020 plot of the board overlaid with a coordinate grid for checking purposes. Program WINNOW is written for the CDC 3600 computer and for the UNIVAC 1108 computer. The 1108 program has two versions: a standard version which will handle the data for a board containing about 800 terminals, and a segmented version for about 1400 terminals. Author (NSA)

N70-13614# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN RELIABILITY PROBLEMS OF HOMOGENEOUS UNIVERSAL COMPUTERS
V. G. Khoroshevskii 17 Jul. 1969 15 p refs Transl. into ENGLISH from Vychislitel'naya Sistemy (USSR), no. 23, 1966 p 69–89
(AD-693840; FTD-HT-23-426-68) Avail: CFSTI CSCL 9/2

The basic reliability characteristics of a single computer and of a homogeneous universal computer system with reserve and recovery are considered. Their basic properties are determined: reliability functions, frequency of breakdown, average time of proper operation, degree of failure and recovery functions. Practical results obtained in verifying the reliability formulas for the Minsk-2 computer are described. Functions of readiness, reliability and recovery for universal computer systems with reserve and recovery are investigated. A general approach is developed for computing the reliability of such systems. The Erlang method is used to investigate several methods of restoring computer systems which are most frequently encountered in practice. Results of computing the readiness factor and evaluating the reliability functions as well as the recovery time for the Minsk-222 computer are presented. Author (TAB)

N70-13748# Illinois Univ., Urbana. Biological Computer Lab.
AN OBJECTIVE FUNCTION FOR COMPUTER SYSTEMS SCHEDULING
Heinz Bielowski 15 Oct. 1968 24 p refs
(Grants AF-AFOSR-7-67; OEC-1-7-071213-4557)
(AD-678164; BCL-4.2; AFOSR-68-2583) Avail: CFSTI CSCL 9/2

The obvious scheduling goal is formulated in terms of the maximum long term revenue of an installation. The consequences for the scheduling operations are derived by introducing the concept of 'revenue functions', which represent the contribution of each job in dependence of the response time. The application of this criterion, together with some a priori information on the computing tasks, could enable the system to adapt its behavior to various job mixes. The drawback of the common scheduling and priority systems are reviewed in the light of the proposed revenue analysis. Author (TAB)

N70-13848*# Mathematical Applications Group, Inc., White Plains, N.Y.
DESCRIPTION OF THE GDC PROGRAM FOR THE GRAPHIC DISPLAY OF THREE-DIMENSIONAL MODELS PREPARED BY THE COMBINATORIAL GEOMETRY TECHNIQUE
W. Guber Aug. 1969 20 p ref
(Contract NAS5-11702)
(NASA-CR-107310; MR-6907) Avail: CFSTI CSCL 09B

The GDC (Graphic Display of Combinatorial Geometry) program is a FORTRAN 4 code for the display (on the EAI Data Plotter 3500) of orthogonal views of models prepared by the combinatorial geometry technique. The program operates on any large IBM 360 and produces a plot tape for input to the EAI Data Plotter 3500. The code consists of a main program which generates the curves (from a user-supplied viewing angle) to be plotted, a set of subroutines comprising the combinatorial geometry package and a set of subroutines to output the curves on a tape for use by the EAI plotter. The basic program reads in the combinatorial geometry description, reads in the viewing angle parameters, generates curves to be plotted, and finally generates the plot tape. Author

N70-13951# National Physical Lab., Teddington (England). Numerical and Applied Mathematics Div.
A PROPOSED SPECIFICATION OF A CONVERSATIONAL COMPUTING SYSTEM FOR NPL
W. Morven Gentleman and W. A. Murray Aug. 1969 34 p refs
(NPL-Ma-78) Copyright. Avail: CFSTI

Experience with current conversational computing systems like Joss or Telcomp has shown that they are very popular with

computing novices and others who require small calculations but as users become more experienced and the size and complexity of problems grow such systems become frustrating because they are so slow and inefficient. Moreover, with the notable exception of Rush, all these systems use languages unlike any batch language and so the powerful program preparation and testing advantages of conversational computing cannot be used to develop programs, software packages, and subroutines for later use in batch mode. The purpose of this specification is to show, by presentation of a detailed design, how these two drawbacks can be overcome at little cost to the amount of computer assistance, the flexibility, and and the simplicity desired by the novice user. Much of the system can be constructed using standard, existing software. The proposed system is designed for conversational, numerical computing from a standard (e.g. teletype) terminal. Many of the considerations apply to the other kinds of conversational system (from other kinds of terminal) which a good multi-access computer should offer, for example test editing and interactive graphics. The high level language ALGOL was chosen to form the basis of this system, but there is nothing essential in this choice. Author (ESRO)

N70-13993# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS REVIEW, VOLUME 3, NO. 8
Wade B. Holland, ed. Aug. 1969 157 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-693121; RM-6000/8-PR-Vol-3-No-8) Avail: CFSTI CSCL 9/2

This issue includes two conference reports on the design program for ASVT modular hardware, and two articles discussing the causes of the time lag in implementing new technology. A summary of the Soviet view of writing programming languages is given in an article announcing the ALGOL 60-based ALPHA language, now used to compile BESM-6 code on the M-20 computer. The Recursive Functions Algorithmic Language (REFAL), used on the BESM-6, is also discussed. Articles on computer hardware include discussions of the (1) UP-1 two-way analog/digital converter using Ural-10 modules; (2) Promin computer to process experimental data; (3) Kaktus system of computer-monitored instruction; (4) KVN-5 device for automatic vacuum spraying of thin films; (5) ChARS reader for typewritten data; (6) VNIIem-3 control computer for industrial use. A new book on the problem of optimality is of considerable interest (1) because optimality is one of the important problems now being studied by cybernetic methods, and (2) because of the publishers forward and disclaimer. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-12720# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
ULTRASONIC FREQUENCY ANALYSIS
H. L. Whaley and K. V. Cook Sep. 1969 25 p refs Presented at 29th Intern. Conv., Am. Soc. for Nondestructive Testing, Philadelphia, 13 – 16 Oct. 1969
(Contract W-7405-eng-26)
(ORNL-TM-2655; CONF-691005-1) Avail: CFSTI

In order to increase understanding of frequency effects in ultrasonic testing, a system was developed which can analyze the frequency content of reflected or transmitted ultrasonic pulses. The system is composed of commercially available electronic equipment and can be used with conventional ultrasonic instruments operating in either a contact or immersion mode. The system was used to examine the frequency effects of the following ultrasonic test variables: transducer type, ultrasonic instrument type, transducer positioning, tuning devices, and collimation. Author (NSA)

N70-12736* Statham Instruments, Inc., Oxnard, Calif.
CALIBRATABLE PRESSURE SWITCH Final Technical Report
P. R. Perino Sep. 1968 168 p
(Contract NAS8-20566)
(NASA-CR-107144) Avail: CFSTI CSCL 09A

This contract was issued to cover a program for the design, development, fabrication, qualification testing, and delivery of two electronic pressure switches. The contract consisted of the following four phases: (1) design and development; (2) fabrication of preflight certification switches; (3) preflight certification testing; and (4) fabrication and delivery of production pressure switches. This report covers the work performed during the entire contract in a comprehensive manner and is self-contained. Author

N70-12737*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
POWER DENSITY MEASUREMENTS Test Report
30 Jun. 1969 26 p refs
(NASA-TM-X-64013; TR-963) Avail: CFSTI CSCL 09A

Described are power density measurements conducted at the vehicle assembly building, launch complexes, and pad as well as the pulse densensitization measurements which were performed as a result of power density measurements. Discussed are techniques and instrumentation used in performing these measurements and an evaluation of the measurements results. Author

N70-12741# Sandia Corp., Livermore, Calif.
VARIABLE COAXIAL CABLE COMPENSATORS
H. R. Johnston Aug. 1969 75 p refs
(Contract AT(29-1)-789)
(PB-185834; SCL-DR-69-61) Avail: CFSTI CSCL 9A

The report describes the design and testing of variable coaxial cable compensators. A 185-ohm compensator which is used with piezoresistive gage power supplies and a 50-ohm multi-use variable cable compensator are discussed. These units compensate RG/213 coaxial cable from 500 feet to 2,000 feet in length. System pulse rise times of 14 nanoseconds are obtained using 2,000 feet of RG/213 cable. Author (USGRDR)

N70-12782# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE AMPLIFICATION OF FREQUENCY MODULATED MICROWAVE SIGNALS BY INJECTION LOCKED GUNN EFFECT OSCILLATORS
Arthur Eugene Burns, III (M. S. Thesis) Apr. 1969 64 p refs
(AD-693034) Avail: CFSTI CSCL 9/5

Although it has been known for many years that under the proper conditions an oscillator can lock to and follow an external signal of much smaller amplitude, this phenomena has not had widespread usage. The development of negative resistance solid state oscillator diodes, such as the Gunn diode, has brought about renewed interest in the locked oscillator, however. The locking characteristics of an X-Band Gunn-effect oscillator have been investigated. The theory of injection locking is discussed and the experimental work performed is described. Amplifier performance of 20 db gain with 40 MHz bandwidth and 30 db gain with 13 MHz bandwidth is reported. The advantages of the locked Gunn-effect oscillator as an amplifier for frequency modulated signals are its minimal power supply requirements, small size, low weight, and simplicity. Author (TAB)

N70-12797# Atomic Weapons Research Establishment, Aldermaston (England).
GLAZING DEFECTS IN THE CONSTRUCTION OF MULTILAYER CIRCUITRY FOR COMPUTERS
R. H. Buck May 1969 25 p refs
(AWRE-0-24/69) Avail: CFSTI; HMSO 3s

The requirements of an air-fired glaze and a vacuum-evaporated metal conductor system as part of a multilayer interconnection module are discussed. In particular, the compatibility of the constructional materials in the process environment of the system is illustrated by the occurrence of glazing and conductor defects where use is made of a screen-printed commercial lead-containing glaze and evaporated gold chromium conductors. One type of glazing defect, resulting from the use of an otherwise ideal commercial glaze, has been examined in an effort to determine its origin. Preliminary results are presented. Author (NSA)

N70-12813# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
ELECTRON BEAM RESEARCH Final Report, 1 Jan. 1960 – 30 Jun. 1968
Richard W. Grow Jun. 1969 25 p refs
(Contract Nonr-1288(05))
(AD-693163; UTEC-MD-69-092; TR-ONR-9) Avail: CFSTI CSCL 9/1

Contents: Coupled ladder transmission lines for O-type interaction; Cerenkov couplers and finite-smooth dielectric amplifiers; Fast-wave cyclotron devices; Circuitless amplification techniques; Cyclotron wave amplification with electron beams; and a plasma-loaded helix amplifier. TAB

N70-12835# Sandia Corp., Livermore, Calif.
NUMERICAL PREDICTIONS OF THE MOTION OF MAGNETICALLY ACCELERATED FLYER PLATES
R. W. Reynolds and R. S. Jacobson Jul. 1969 34 p refs
(Contract AT(29-1)-789)
(SCL-DR-69-44) Avail: CFSTI

Capacitor banks were successfully used to accelerate flyer plates for impulse testing. The predictions of the motion of the flyer plate should be of considerable assistance in the design of capacitor banks and flyer plates. The motion of the flyer plate was studied with the aid of a circuit equation and an equation of motion. These two equations were derived in general, applied to a flat flyer geometry, and then solved numerically using a Runge – Kutta technique. A series of experimental tests was conducted with a capacitor bank. The results of these tests were in very good agreement with the numerical predictions. Author (NSA)

N70-12944# Sandia Corp., Livermore, Calif.
FABRICATING NARROW CONDUCTORS ON LARGE FLEXIBLE SUBSTRATES
H. R. Johnson Oct. 1969 16 p refs
(Contract AEC AT(29-1)-789)
(PB-186202; SCL-DR-69-76) Avail: CFSTI CSCL 09E

An unusually large, flexible printed wiring board was developed for use as an initiator of sheet high-explosive in various configurations. The board consists of long, narrow, parallel conductors on a thin Mylar substrate two and a half by five feet. Parts of this size, too large to be handled on ordinary fabricating equipment, were produced by adapting either of two older processes, silk screening and photolithography. Art-work was prepared with a light-head plotting machine. Conductors 0.010 inch wide, spaced 0.018 inch apart, were produced by the silk-screening technique. Conductors ranging in width from 0.002 to 0.020 inch, spaced at various intervals, were produced by the photolithographic technique. Author (USGRDR)

N70-12967# Technische Hochschule in Graz (Austria). Inst. fuer Theoretische Physik.
LOW-FREQUENCY LOOP ANTENNA ARRAYS Final Technical Report
Ernst Ladinegg Jul. 1969 114 p refs
(Contract DAJA37-68-C-0893)
(AD-693271; ARDG(E)-E-1346) Avail: CFSTI CSCL 9/5

The present report treats the radiation properties of loop antenna systems which are situated above the ground and are centrally excited by a source of current. The current reaction due to the earth, the mutual induction and the radiation reaction are taken into account. The theory considers two loop-systems, viz., the horizontal loop-system and the vertical loop-system where the surface normal of the loops is vertical and parallel to the earth, respectively. For both systems explicit formulae are derived which contain a number of typical geometrical and physical parameters. The work is divided into three main sections. Sections A and B deal with the theory of the current reaction of the ground for horizontal and vertical loop-antennas where the influence of the earth is described by a resistance induced into the loop. Further, the calculation of the mutual influence between the loops of the system is performed which is also to be characterized by resistance coefficients. Section C is directed to the calculation of the radiation fields for both systems and is performed on the basis of the antenna currents presented in sections A and B. The explicit representation of the radiation fields is effected by a systematic application of the saddlepoint method of first and second order with which the occurring Sommerfeld integrals are evaluated. In this context it has been shown that the radiation field for special loop-antenna systems near the ground can be calculated rigorously. Author (TAB)

N70-13021# Sandia Corp., Albuquerque, N. Mex. Solid State Electronics Research Div.
PHYSICAL PROCESSES IN DIELECTRIC LIQUID SWITCHES
Ralph H. Plumlee Jun. 1969 63 p refs
(PB-184725; SC-RR-69-355) Avail: CFSTI CSCL 09A

Prospective high field conduction and src initiation processes are analyzed to account for the current drawn between slowly closing (<10 m/sec) metal contacts in dielectric liquids. Condensed-phase processes considered are field emission and thermionic runaway electron injection by contact asperities, high field ambi-polar injection, electron impact avalanche multiplication, and (nontrapping) space-charge-limited electron flow. Author (USGRDR)

N70-13022# Los Alamos Scientific Lab., N. Mex.
A LOW-RESISTANCE VOLTAGE DIVIDER FOR PHOTOMULTIPLIERS
H. Jung and M. Bruellmann [1968] 6 p Transl. into ENGLISH from Nucl. Instr. Methods (Amsterdam), v. 65, no. 178, 1968 6 p
(LA-4115-TR) Avail: CFSTI

The stability of a photomultiplier at high counting rates required the use of a low-resistance voltage divider for the last few dynodes. This has been achieved by means of a transistor circuit that stabilizes the potentials of the last three dynodes by comparison with the corresponding potential of an unloaded resistance voltage divider. The dynode voltages can thus be varied over a wide range. The temperature dependence of the elements has been practically eliminated by means of a symmetrical circuit design. Author (NSA)

N70-13189# Hitemp Wires Co., Westbury, N.Y.
MINIATURE TRI-LEAD RF TRANSMISSION LINES
Horst Kuettner 1968 26 p refs Presented at 17th Intern. Wire and Cable Symp., Atlantic City, 4 – 6 Dec. 1968
(AD-678160) Avail: CFSTI CSCL 9/1

The concept, design, use and manufacturing considerations of miniature RF transmission lines which operate at low voltage and current levels are presented. The rectangular tri-lead cable, in which the center signal conductor is paralleled by two ground conductors exhibits some desirable properties, primarily closely controlled characteristic impedance. Author (TAB)

N70-13280# Sandia Labs., Albuquerque, N. Mex.
PRECISION CURRENT CONTROL FOR TUNGSTEN RIBBON FILAMENT LAMPS
R. B. Foster Sep. 1969 11 p
(PB-186085; SC-DR-69-554) Avail: CFSTI CSCL 14B

An automatic system to program the current through tungsten ribbon filament lamps has been developed. Tungsten ribbon filament lamps are used in the calibration of optical pyrometers from 800C to 2300C. For maximum accuracy, the current through the lamps needs to be known to 1 part in 10,000. The system developed determines and regulates the lamp current to better than 1 part in 10,000. Author (USGRDR)

N70-13289# Sandia Corp., Albuquerque, N. Mex.
MATHEMATICAL MODEL OF A STRIP-LINE OSCILLATOR
Sidney Frankel Jul. 1969 155 p refs Sponsored by AEC
(PB-186054; SC-DR-69-377) Avail: CFSTI CSCL 09E

In order to provide a flexible means for studying the effects of manufacturing tolerances and other variations on circuit performance, a strip-line oscillator has been modeled, both in open-loop and closed-loop form, on a digital computer. Fourteen variable parameters are specified for determining the growth rate and frequency of the oscillator signal. Programs for computing equivalent lumped oscillator impedances have also been established. Parameter sensitivity coefficients are readily determined by numerical differentiation. Author (USGRDR)

N70-13338# Syracuse Univ. Research Inst., N.Y. Dept. of Electrical Engineering.
ARRAY DESIGN BY MATRIX METHODS
Bradley J. Strait and Kazuhiro Hirasawa 1 Oct. 1968 18 p refs
(Contract F19628-68-C-0180)
(AD-678089; AFCRL-68-0542; SR-1) Avail: CFSTI CSCL 9/5

A new method is presented for designing arrays of parallel wire antennas. The method relates a desired pattern directly with required feed voltages such that mutual coupling is taken into account in the design procedure. The technique uses matrix methods together with results of the Method of Moments to determine the self and mutual impedances and the required excitations. The design method can be applied to circular, elliptical, and other planar arrays, although attention is restricted here to linear arrays. The feed points and the array geometry must be specified. An example is included. Author (TAB)

N70-13345# Missouri Univ., Rolla. Space Sciences Research Center.
DETERMINATION OF TRANSISTOR CHARACTERISTICS AFTER NEUTRON RADIATION
J. L. Azarewicz, T. D. Beckman, J. Bereisa, Jr., and C. A. Goben 1969 5 p refs Presented at the Conf. on Nucl. and Space Radiation Effects, University Park, Pa.
(Contract AT(11-1)-1624)
(COO-1624-16; CONF-690704-6) Avail: CFSTI

A model was developed for the neutral base region of a transistor using closed form solutions of the continuity equation which accounts for both the effect of recombination and built-in electric field in the base region. This model was applied to the study of neutron radiation effects in double diffused devices and predicts the steady state concentration of excess minority carriers in the base region as a function of injection, electric field, distance, and neutron fluence. Predictions are presented graphically. NSA

N70-13353# California Univ., Berkeley. Lawrence Radiation Lab.
USE OF SUPERCONDUCTING JUNCTIONS IN MAGNETOMETRY
J. Clarke Jun. 1969 15 p refs Presented at Natl. Center of Space Studies Meeting, Paris
(Contract W-7405-eng-48)
(UCRL-19030; CONF-690529-1) Avail: CFSTI

A superconducting device which has proved useful in the measurement of electric currents down to 30 nA, voltages down to 10 to the minus 15th Volts, and magnetic fields down to 10 to the minus 8th power Gauss is described. The properties of a type of Josephson junction in which the conventional oxide barrier is replaced by a copper barrier are discussed. Author (NSA)

N70-13363# California Univ., Santa Barbara. Dept. of Electrical Engineering.
LOW-PASS, QUASI-OPTICAL FILTERS FOR OVERSIZED OR FOCUSED-BEAM WAVEGUIDE APPLICATIONS
G. L. Matthaei and D. A. Leedom 1969 38 p refs
(Grant NSF GK-1238)
(PB-185840) Avail: CFSTI CSCL 09A

A form of low-pass, quasi-optical filter for millimeter wave and possibly infrared applications is described which consists of thin layers of dielectric interspersed with arrays of thin metallic strips in a manner similar to an artificial dielectric. Equivalent circuits for filter half sections of the type used were developed, and formulas and graphs are presented from which image parameters for such half section can be obtained. A design procedure is given from which multisection filters of this type can be designed from low-pass, lumped-element prototypes in order to give prescribed transmission characteristics. Some trial designs were worked out and fabricated for use in oversized waveguide, and their responses were computed in detail with a digital computer. Author (USGRDR)

N70-13375# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
FABRICATION OF TUNNEL JUNCTIONS ON NIOBIUM FILMS
L. O. Mullen and D. B. Sullivan Repr. from J. Appl. Phys., v. 40, no. 5, Apr. 1969 p 2115-2117 refs
(PB-186354; R-517) Avail: CFSTI CSCL 09A

High background currents, often observed in tunnel junctions when the barrier is formed by oxidizing niobium, probably stem from the fact that one oxide of niobium (NbO) is not an insulator. The fabrication process described in this paper used an active layer of gas adsorbed on the niobium surface that reacts with the upper film (e.g., lead) and forms the junction barrier. This technique avoids the problem above and results in tunnel junctions with low background currents. Author (USGRDR)

N70-13386# Institute of Nuclear Research, Warsaw (Poland).
TEMPERATURE STABILITY OF THE VOLTAGE STANDARD USING ZENER DIODES
Jerzy Pazdzierski 1968 25 p refs In POLISH
(INR-1021) Avail: CFSTI

The compensation methods of the Zener diode voltage change caused by the variation of the temperature are discussed. Simple circuits for temperature compensation of the voltage standard realized on the available Zener diodes are given and methods of selection assuring temperature stability better than 0.005 %/deg. are described. Author (NSA)

N70-13392# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
THE SUPERREGENERATIVE (SR) AMPLIFIER-LINEAR MODE
Theodore S. George 11 Jul. 1969 60 p refs
(Contract DAAG39-67-C-0077)
(AD-693881; SR-69-2; HDL-0077-12) Avail: CFSTI CSCL 17/2.1

The superregenerative SR amplifier in the linear mode is analyzed from the point of view of a sampling amplifier using a rectangular quench waveform. Necessary conditions are established such that idealized sampling formulae may be applied to the problem. The analysis is carried thru for both high and low input carrier-to-noise ratios. Explicit design formulae are exhibited for such parameters as SR gain, bandwidths, and signal-to-noise ratios. Comparison is made to a superheterodyne receiver in terms of output signal-to-noise ratios for two particular cases of interest. Author (TAB)

N70-13404# Joint Publications Research Service, Washington, D.C.

FIRST INTEGRATED CIRCUIT SERIES DEVELOPED

Laszlo Schronk *In its* Transl. on Eastern Europe: Sci. Affairs No. 83 7 Nov. 1969 p 53-60 Transl. into ENGLISH from Radiotech. (Budapest), Oct. 1969 p 373-375 (See N70-13402 03-34)

Avail: CFSTI

The fabrication, general characteristics, and possible applications of integrated logic and linear circuits is discussed. Integrated logic circuits consist of the following combinations: (1) resistor-transistor; (2) diode-transistor; and (3) transistor-transistor combinations. The first two integrated circuit systems are suitable for functional replacements of logic circuits built with conventional components, whereas the third circuit system can be built only by integrated circuit techniques. Integrated linear circuits are used primarily in the instrument industry and mainly in the various differential, audio and wideband amplifiers; they can be divided into semiconductor circuits with a silicon substrate, and in hybrid circuits with an insulating substrate. Data and diagrams for an integrated three-input gate semiconductor circuit are included. G.G.

N70-13408# Scanwell Labs., Inc., Springfield, Va.

ILS LOCALIZER SYSTEM. VOLUME 1: LOW COST LOCALIZER Final Report

Frederick Fine Feb. 1969 169 p refs

(Contract FAA-ARDS-538)

(AD-693171; SRDS-RD-69-14-Vol-1) Avail: CFSTI CSCL 17/7

The objectives of the contract were to design, develop, fabricate, and deliver a complete low cost localizer system which would be suitable for secondary airports and still provide for all the basic operations of a localizer system. A wide aperture antenna array with suitable directivity about the course line is provided in order to reduce the influence of siting errors. System performance is equivalent or better than ICAO Category I standards. Mechanical modulation is employed in conjunction with a low power transmitter and solid state monitor for long term reliable service. Additional V-Ring Antenna Arrays were delivered for upgrading existing marginal localizer sites. These arrays are commissioned and operating with existing FAA localizer equipment. Additional low cost localizer equipment was added to provide for specialized remote monitor and control functions, including standby equipment with transfer unit. The theory, hardware description, and performance of the low cost localizer system is discussed with conclusions drawn from system performance data and with recommendations for system improvements. Author (TAB)

N70-13437# Army Electronics Command, Fort Monmouth, N.J.

SUPERCONDUCTORS AT SUBMILLIMETER AND HIGHER FREQUENCIES

Gerhart K. Gaule Aug. 1969 41 p refs

(AD-694367; ECOM-3125) Avail: CFSTI CSCL 9/1

This report is based on a survey undertaken to estimate the potential of future superconductive devices at frequencies beyond 30 GHz. The report should also have some usefulness for scientists and engineers in the sub-mm and IR field planning to use low temperature, and in particular, superconductive techniques. Author (TAB)

N70-13441# Syracuse Univ. Research Corp., N.Y. Defense Systems Div.

ANALYSIS OF A CIRCULAR ARRAY OF ANTENNAS BY MATRIX METHODS Interim Report

Jules A. Cummins (Ph.D. Thesis—Syracuse Univ.) Feb. 1969 144 p refs

(Contract NOnr-4798(00))

(AD-694046; DSD-R-232) Avail: CFSTI CSCL 9/5

The problem of determining the current distribution along four metallic cylinders forming a circular array is treated as a boundary-value problem. The array has rotational symmetry about its center and there is image symmetry about a plane through the mid-section of each cylinder. The mathematical formulation involves an integro-differential equation derived from the Maxwells equations plus the boundary conditions at the surfaces of the cylinders. The solution is obtained by the method of moments and the resulting matrix equation is expressed in terms of generalized network parameters. The solution for the currents is then used to find the admittance and impedance parameters describing the array considered as a four-port network. Excitations are found which optimize either the array directive gain or its power gain. A synthesis procedure is described by which the far-zone electric field intensity is constrained to assume desired values in a number of directions equal to the number of independent array excitations. Examples are included showing that the synthesis procedure is effective in reducing the levels of the sidelobes in a given pattern. Throughout this report numerical results are compared with experiment and with solutions obtained by other theoretical methods. Author (TAB)

N70-13461# Akademiya Nauk URSR, Kiev.

TRANSISTOR AMPLIFIER MODULES FOR A LOW-FREQUENCY ELECTRIC GEOPHYSICAL PROSPECTING APPARATUS

L. Ya. Mizyuk and R. B. Prots *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 93 102 refs (See N70-13451 03-23)

Avail: CFSTI

The module described consists of two amplifier stages with direct coupling and an output emitter follower. The circuit parameters are stabilized by direct current negative feedback enveloping the entire module. With direct coupling between stages, temperature-dependent dividers are developed in the base circuits, as a result of which very stable direct current operating modes are achieved for all transistors except the primary. The primary transistor must be stabilized by appropriate selection of the instability factor. The amplification factor of the module can be regulated from 1 to 6 by varying the feedback ratio. Two modules must be switched on in series to achieve an amplification factor from 6 to 30. Transl. by R.B.

N70-13465# Akademiya Nauk URSR, Kiev.

OPERATIONAL ANALYSIS OF AN EVEN HARMONICS MAGNETIC MODULATOR IN THE OVEREXCITED MODE OF ASSIGNED VOLTAGE

R. Ya. Berkman and V. M. Fedotov *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 133 140 refs In RUSSIAN (See N70-13451 03-23)

Avail: CFSTI

Based on a simplified physical pattern of the magnetic reversal of a magnetic modulator core in an excitation mode similar to assigned voltage, functions are derived for calculating the voltage and current sensitivity in an unloaded and short-circuited output winding as a function of the extent of voltage overexcitation of the magnetic modulator. The results show that the opinion prevalent in literature that the percentage of higher harmonics is small in the assigned excitation voltage mode is unfounded; even at the relatively low overexcitation required for practical operation, the percentage of higher harmonics increases sharply. Transl. by R.B.

N70-13466# Akademiya Nauk URSR, Kiev.
ON DESIGNING THE HALL CONVERTER
R. V. Rozhankovskiy *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 141 151 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

The Hall converter usually consists of a normal Hall generator, an electric power source, and a load. Some recommendations are presented on selecting the parameters of indicated elements, in particular, the relative dimensions of the generator for obtaining optimal values of the various characteristics of this type converter. Calculations show that the different characteristics of the Hall converter acquire optimum values at various element parameters. Therefore, for simultaneous optimization of several characteristics (for example, for obtaining linear transmission characteristics at the highest possible efficiency), a compromise solution should be found. Transl. by R.B.

N70-13467# Akademiya Nauk URSR, Kiev.
ON CALCULATING THE FREQUENCY ERROR COMPENSATION OF HALF-WAVE RECTIFIER CIRCUITS
Ye. N. Kurilov *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 152–158 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

Conditions are presented for compensating frequency error for two voltmeter and amperemeter circuits. Calculations show that compensating frequency error by the method of controlled equivalent emf is a special case based on the alignment method. However, the absolute values of calculating errors by these two methods differ significantly. Transl. by R.B.

N70-13570# Harry Diamond Labs., Washington, D.C.
INVESTIGATION OF MINIATURE G-HARDENED ELECTROMECHANICAL CLOCKS: A DIFFERENTIAL-MOTION CLOCK
James Meek May 1969 39 p
(AD-694405; HOL-TM-69-13) Avail: CFSTI CSCL 9/3

Electromechanical clocks for use in high-spin acceleration environments are explored. Criteria of design to insure instrument survival and functioning in the environment are stated. Problems caused by high acceleration such as increased power consumption, frictional losses, inertial coupling due to spin, unbalanced torque loading, and mechanical stresses and deflictions are discussed. The concept of micronization as a solution to many of these problems is advanced. Novel design concepts for clock transducers are described incorporating magnetostrictive, electrostrictive, and electrostatic principles. An electromagnetic, differential-motion clock and several typical electronic drive circuits are described. Numerical computations relative to stresses, power drain, and other effects are given in the appendix. Author (TAB)

N70-13668# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.
HOMOMORPHISMS AND DERIVATIVES OF SPECIAL LIE AND JORDAN RINGS [HOMOMORPHISMEN UND DERIVATIONEN SPEZIELLER LIE- UND JORDAN-RINGE]
Ernst Boenecke (Ph.D. Thesis)
1968 50 p refs In GERMAN
Avail: CFSTI

Special Jordan products and Lie products of associative rings are considered particularly their relationships with the homomorphisms and derivations of the basic associative rings. Some new laws concerning Lie homomorphisms are proved, and rings with idempotant elements are discussed. ESRO

N70-13672# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.
MARKOV REGENERATION PROCESSES WITH AUXILIARY PATHS [MARK OFFSCHE ERNEUERUNGSPROZESSE MIT HILFSPFADEN]
Manfred Schäl (Ph.D. Thesis) 1969 132 p refs In GERMAN
Avail: CFSTI

The asymptotic behavior of Markov processes is investigated for the case when the Markov property holds only for random points in time (regeneration points). A generalization of a semi-Markov process is derived, termed as Markov regeneration process with auxiliary paths. The behavior of such a process in a regeneration point is determined and the convergence properties, and a law concerning the principal limit are derived. Some examples from queueing theory are presented. ESRO

N70-13674# Royal Aircraft Establishment, Farnborough (England).
A BALANCED DIRECT-COUPLED AMPLIFIER USING LINEAR INTEGRATED CIRCUITS
M. J. Broad Jun. 1969 28 p refs
(RAE-TR-69115) Avail: CFSTI

Stable low gain direct-coupled amplifiers using linear integrated circuits are described. They have high common-mode rejection and an adjustable bandwidth, and are particularly suitable for airborne data acquisition systems. Author (ESRO)

N70-13692 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
PULSE SHAPERS FOR STANDARDIZING PHOTOMULTIPLIER SIGNALS AND FOR OTHER APPLICATIONS
H. Verweij and G. Vismara 1969 58 p refs
(CERN-69-26) Copyright. Avail: Issuing Activity

Two general purpose pulse shapers are described. They convert signals from photomultipliers and other sources to pulses of logic amplitude (−800 mV) and adjustable width. The input circuits of both units are identical, also their output circuits, but the output pulse-width is defined differently. In one case it is determined by a coaxial cable (type N2620), and in the other by an inductance (type N 2618). The input threshold is fixed and equal to −50 mV or −350mV. An output fan-out delivers two dual logic outputs and one dual complementary logic output. The minimum output pulse width is approximately 3.2 msec. The maximum frequency of operation is at least 100 MHz. The units are part of the CERN-NIM compatible nucleonic instrument range. Author

N70-13705*# Solid State Scientific Corp., Montgomeryville, Pa.
INVESTIGATION INTO THE COMBINATION OF COMPLEMENTARY MOS AND COMPLEMENTARY BIPOLAR CIRCUITS ON A MONOLITHIC SILICON CHIP Final Report
Robert Cook [1969] 23 p
(Contract NAS5-21012)
(NASA-CR-107306) Avail: CFSTI CSCL 09A

The design and fabrication of special engineering photoresist mask set and read/write buffer circuits are reported. The new technology was named complementary squared, or C-squared. Among the conclusions are the following: Both high speed and low leakage can be obtained using C-squared techniques. Only two additional process steps are necessary for the fabrication of C-squared versus C MOS alone. Both types of bidirectional buffer circuits functioned electrically. The C-squared method offers a dynamic performance improvement from 10 to 25 times that of C MOS. The observed high speed performance at +5 volts is compatible with conventional TTL circuits. The chip area is not appreciably increased by using the C-squared method. Author

N70-13740# Los Alamos Scientific Lab., N.Mex.
THE SQUARE ROOT OF N AND THE AVALANCHE PULSER
R. R. Fullwood and J. E. Gallegos 12 Sep. 1969 6 p
(Contract W-7405-eng-36)
(LA-4182) Avail: CFSTI

A lossless fanout would have a voltage attenuation of square root of N, where N is the number of outputs. A prototype 64-N fanout that has a loss of 8%, a maximum-to-minimum output ratio of 1.4, and poorest output rise time of 20 nsec is constructed. The delay is 15 nsec, but the outputs are matched to 8 psec. Also, construction of a Cockcroft-Walton avalanche pulser that develops 300 V on a 50- Omega load using cheap epoxy transistors is described. The rise time and delay are 10 nsec, the jitter is less than 1 nsec, and the exponential decay time is 150 nsec. Author (NSA)

N70-13762# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EXCITATION OF A GENERATOR-AMPLIFIER SYSTEM

E. P. Chechenina et al 22 May 1969 10 p refs Transl. into ENGLISH from An SSSR. Doklady (Russian), v. 10, no. 12, 1966 p 929–932

(AD-693942; FTD-HT-23-80-69) Avail: CFSTI CSCL 20/5

The authors calculate the emission produced by a generator-amplifier system with allowance for their mutual influence (i.e., the feedback between the generator and the amplifier), for different parameters of the active medium and of the resonator. The properties of such a system are compared with those of a system in which the quantum generator and the quantum amplifier are considered separately, so as to determine the region of parameters in which the feedback must be taken into account. The calculation is based on energy relations with allowance for the dependence of the gain of the active medium on the radiation density. The investigation shows that the mutual influence of the generator and the amplifier in such a compound system must be taken into account if the amplifier length is shorter than or equal to the length of the driver generator, or when the amplifying section is long but the reflection coefficients are close to the threshold values. TAB

N70-13795*# TRW Systems Group, Houston, Tex. Electronic Systems Lab.

APOLLO COMMUNICATIONS SYSTEM. TASK E-59B: MSFTP-2 BIT SYNCHRONIZER PERFORMANCE ANALYSIS

H. W. Belles, D. A. Laws, and R. A. Van Cleave 27 May 1969 304 p refs

(Contract NAS9-8166)

(NASA-CR-102035; TRW-11176-H236-R0-00) Avail: CFSTI CSCL 09A

The scope of the analysis includes derivation of a mathematical model describing the bit sychronizer performance as applied in the MSFN network, hardware error analysis of the bit synchronizer to predict and bound its circuit error contributions, and laboratory testing of the bit synchronizer for comparison with predicted results. From the mathematical model, parametric curves are generated showing performance degradation as a function of signal-to-noise ratio, transition density, dc offset, timing error, and prefiltering characteristics. The hardware error analysis, along with the parametric curves, are used to predict the actual performance of the operational hardware. Test results from the bit synchronizer are compared with the predicted results. The nominal predicted performance degradation for normal operating conditions is 2.5 db from theoretical. This includes approximately 0.7 degradation attributed to prefiltering in the communications link. The worst case predicted performance, including measurement errors, is 2.9 db. Author

N70-13837# Harry Diamond Labs., Washington, D.C.

COMPARISON OF POTENTIAL STEP AND TRIANGULAR VOLTAGE SWEEP METHODS OF DOUBLE-LAYER CAPACITANCE MEASUREMENTS

Werner H. Steuernagel Aug. 1969 24 p refs

(AD-694407; HDL-TR-1459) Avail: CFSTI CSCL 9/1

A comparison was made of the potential step and triangular voltage sweep methods for obtaining the double-layer capacitance of a porous electrode. Electrolytic capacitors varying from 2000 to 27,800 microfarads were used as standards. The effects of faradaic current were investigated. A linear relationship, independent of capacity, was found between the error in the capacitance measurement and the faradaic current for the potential step method. The potential sweep method gave slightly better results than did the potential step method in the presence of a changing faradaic current. Distributed capacity effects were not considered in the study. Author (TAB)

N70-13840# TRW Systems Group, Redondo Beach, Calif.

THE EFFECT OF WIRE PLATING ON THE RELIABILITY OF CRIMPED CONTACTS

R. E. Corcoran 1968 8 p Presented at 17th Intern. Wire and Cable Symp., Atlantic City, 4–6 Dec. 1968

(AD-677900) Avail: CFSTI CSCL 9/1

Four groups of specimens were assembled for test in the following manner: Group A - Tin plated 26 AWG wire thermally stripped at normal temperature and contact crimped; Group B - Tin plated 26 AWG wire mechanically stripped and contact crimped; Group C - Tin-plated 26 AWG wire thermally stripped at excessively high temperatures (jacket and insulation charred) and contact crimped. Group A, B, C and D contacts were all crimped with the same tool and positioner to limit variables. The silver-plated wire was added to the test because previous test data accumulated by the manufacturer showed no previous contact resistance failures with 26 AWG silver-plated wire. The results showed that all groups met the initial contact resistance requirement of 7 milliohms maximum but the Group D specimens (silver-plated wire) were the only group to meet the contact resistance requirements after 40 cycles of thermal shock. Author (TAB)

N70-13882# Naval Research Lab., Washington, D.C.

A SIMPLIFIED DC-TO-DC CONVERTER WITH CONSTANT AVERAGE OUTPUT VOLTAGE Final Report

Joseph M. Marzolf 7 Aug. 1969 9 p ref

(AD-694452; NRL-6940) Avail: CFSTI CSCL 9/5

The article describes dc-to-dc static converter circuit providing a constant average output voltage over a wide range of input voltages. The output, a pulsating dc, is basically pulse-width modulated to obtain a constant average voltage. The system consists of an unsymmetrical converter utilizing a square-loop magnetic core with the characteristic such that the secondary voltage is directly proportional to the primary voltage and the time to saturate the core is inversely proportional to the primary voltage. Each cycle is triggered by a unijunction oscillator at a constant frequency. Author (TAB)

N70-13885# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.

EXTENSION OF THE THEORY OF UNIFORM-PERIODIC IRIS-LOADED DEFLECTORS TO PI/2-MODE BIPERIODIC STRUCTURES

H. Hahn 24 Apr. 1969 32 p refs Supported by AEC

(BNL-13718) Avail: CFSTI

The extension of the rigorous theory of uniform-periodic iris-loaded deflectors to standing-wave pi/2-mode biperiodic cavities is presented. Two versions of the solution for uniform-periodic deflectors are used. The first version is based on field matching similar to the early theories but it differs from these by the normalization procedure used. The second version is directly derived from the variational principle and matches the radial complex power flow along the interface rather than field components. It is shown that both versions represent a variational solution and lead to the best solution attainable with a given number of arbitrary coefficients in the field expansion. NSA

N70-13934# Helsinki Univ. (Finland). Radio Lab.

MAXIMUM BANDWIDTH PERFORMANCE OF A

SINGLE-VARACTOR PARAMETRIC AMPLIFIER WITH A SINGLE-TUNED IDLER CIRCUIT
V. Porra 1969 5 p refs
(Rept-S-30) Avail: CFSTI

This article presents a theory on the optimum design of a broadband parametric amplifier when the idler circuit is single-tuned. The theory is more accurate than those of previous authors because it takes into account the real properties of the separation filter between the signal and idler circuits, the most important parasitic elements of the varactor, and the limitations caused by the use of both transmission lines and lumped elements. The result obtained is the optimum design of the separation filter and the optimum value of the idler frequency for a prescribed varactor. Author (ESRO)

N70-13939# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
ON THE APPLICATION OF SEMICONDUCTOR PHASE-SHIFTING FOR INERTIALESS ELECTRONIC ANTENNA SCANNING AT MICROWAVE TO MILLIMETER WAVE FREQUENCIES: INSERTION LOSS LIMITATIONS [SUR L'APPLICATION DU GLISS DE PHASE DES SEMI-CONDUCTEURS AU BALAVAGE ELECTRONIQUE SANS INERTIE D'ANTENNES AUX FREQUENCES DE MICRO ONDES OU MILLIMETRIQUES: LIMITATION DES PERTES D'ENTREE]
Eugène A. Graham 1969 20 p refs Presented at the IEEE Intern. Conf. on Commun., Boulder, Colo., 9–11 Jun. 1969 Submitted for publication
(ONERA-TP-712) Avail: CFSTI

Inertialess scanning of antennas at millimeter wave frequencies, essential for certain desired commercial and military uses, presents particular problems because of the frequencies involved and the nature of the antennas thereby necessitated. The theory and use of semiconductor microelectronics for such purpose is treated, taking into account the special problems involved. It is shown that new ideas in semiconductor diode construction permit this realization in suitably simple configurations. Special emphasis is placed on solution of the crucial insertion loss problem, which is the key to successful inertialess antenna scanning at millimeter wave frequencies; such solution is made possible by the new diode construction procedures. It is further seen, in particular, that the exceedingly small amounts of control power necessary in the new antenna scanning technique is an added, non-negligible advantage. Author (ESRO)

N70-14061# Army Missile Command, Redstone Arsenal, Ala. Future Missile Systems Div.
DIELECTRIC ROD-FILLED METALLIC WAVEGUIDES OF GENERAL CROSS SECTION
Fan King 26 Aug. 1969 78 p refs
(AD-693783; RF-TR-69-3) Avail: CFSTI CSCL 9/1

The problem of dielectric rod-filled metallic waveguides of general cross section has not been attempted. Only the special case of a circular cross section has been investigated and analyzed extensively and theoretically. The equations for this special case of a cylindrical waveguide filled coaxially with a dielectric rod were developed for the TM, Te, and hybrid modes. These equations were verified with results found in the literature to excellent agreement. The presence of new higher order modes are found in all cases considered. The point-matching method was applied to the dielectric rod-filled metallic waveguide of general cross section. Equations which match the boundary conditions were developed and programmed for a UNIVAC 1108 Digital Computer. A singularity exists when the point-matching equations are applied to the special case of the dielectric rod loaded coaxially in cylindrical waveguides. Attempts to obtain solutions near this singular point were unsuccessful because of a region of unreliable and unstable solutions. Stable solutions were obtained for the eccentrically loaded dielectric rod in cylindrically shaped waveguide, but verification is not possible at present. Author (TAB)

N70-14071# Air Force Systems Command, Wright-Patterson AFB, Ohio.
DETERMINATION OF OPERATING TEMPERATURE OF ELECTROLUMINESCENT CELLS
Kh. Ya. Kalder and K. S. K. Rebane Mar. 1969 12 p refs Transl. into ENGLISH from Akad. Nauk Estonskoi SSR, Tallinn. Inst. Fiziki i Astronomii (Moscow) no. 31, 1966 p 246–254
(AD-693938; FTD-HT-23-1228-68) Avail: CFSTI CSCL 20/6

The average temperature of the luminescence layer of an electroluminescent cell was measured, and it was found that the temperature increase in the layer is proportional to the power absorbed by the cell. The local temperature of the emission centers in an electroluminophor did not exceed the average temperature of the cell. A small shift, 10 to the -5th power eV/V, of the electroluminescence emission band towards the longer wavelength in comparison with photoluminescence was found. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-12985# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SUMMARY OF RESEARCH CARRIED OUT FROM JANUARY–JUNE 1969
Jun. 1969 177 p refs
(Contract N00014-67-A-0226)
(AD-693517) Avail: CFSTI CSCL 9/3

The document presents a summary of research carried out by the School of Electrical Engineering of Purdue University from January to June, 1969. TAB

N70-13073# Polytechnic Inst. of Brooklyn, N.Y.
CAPACITY OF AN ADDITIVE GAUSSIAN COLORED NOISE CHANNEL WITH NOISELESS FEEDBACK
Thomas W. Eddy and Jack K. Wolf 1968 11 p refs Reprinted Prepared jointly with Bell Telephone Labs., Whippany, N.J.
(Contract AF 49(638)-1600)
(AD-678191; AFOSR-68-2531) Avail: CFSTI CSCL 9/4

In this paper the capacity of a nonbandlimited additive gaussian colored noise channel with noiseless feedback is derived. It is proved constructively that the capacity for such a channel is given as Cfb = Pavg/2 min Sn (omega) where Pavg is the average transmitted power and Sn (omega) is the spectral density of the additive noise in the forward channel. With this result it follows that the capacity of the channel with feedback can be larger than the capacity of the corresponding channel without feedback. Author (TAB)

N70-14036# Consiglio Nazionale delle Ricerche, Turin (Italy). Labratorio di Cosmo-Geofisica.
TEMPERATURE INFLUENCE ON ELECTRONIC EQUIPMENT FOR MEASURING INTENSITY VARIATIONS OF COSMIC RADIATION [INFLUENZA DELLA TEMPERATURA SULL'ELETTRONICA NELLE MISURE DI VARIAZIONI DI INTENSITA DELLA RADIAZIONE COSMICA]
E. Antonucci and A. Piano [1969] 17 p refs In ITALIAN

Its Rapporto Interno No. 11
Avail: CFSTI

The effects of ambient laboratory conditions, such as temperature and humidity, on electronic equipment used to measure the intensity of cosmic radiation are determined experimentally. A coincidence discriminator is subjected to various tests and it is found that linearity and the resolution time are largely independent of ambient conditions. ESRO

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-13084*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
OBSERVED VIBRATION ENVIRONMENT OF A PANEL VAN FOR REPRESENTATIVE URBAN ROAD CONDITIONS
Clarence B. Beaudrot 1 Oct. 1969 14 p refs
(Contract NAS7-100)
(NASA-CR-107199; JPL-TM-33-427) Avail: CFSTI CSCL 14B

This report provides shock and vibration information for a single rear-axle panel van with leaf-spring suspension. Previous reports have given the measured characteristics of tandem-axle vans with air-ride suspensions, but little information was available on panel trucks. The equipment and procedures used in this test were similar to those noted above, but the statistical sampling of data was much smaller. Author

N70-13118# Sandia Corp., Albuquerque, N. Mex.
PRIMACORD EXPLOSIVE-DRIVEN SHOCK TUBES AND BLAST WAVE PARAMETERS IN AIR, SULFURHEXAFLUORIDE AND OCTOFLUOROCYCLOBUTANE (FREON-C318)
M. G. Vigil *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 53–62 refs (See N70-13112 03-32)
Avail: CFSTI

The 6- by 200-foot and the 2- by 200-foot primacord (PETN) explosive driven shock tubes are described. The purpose, main characteristics, and maximum capabilities of the two facilities are discussed. The scaling or similarity factors applicable between the two shock tubes are developed through dimensional analysis and the laws of similitude. Experimental data from 70 shock tube tests are presented to confirm the validity of the scaling laws. Data are presented for the three test gases: air, sulfurhexafluoride, and octofluorocyclobutane. Author

N70-13121# Collins Radio Co., Cedar Rapids, Iowa.
SLINGSHOT SHOCK TESTING
La Verne Root and Carl Bohs *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 73–81 refs (See N70-13112 03-32)
Avail: CFSTI

The paper covers 3 years of testing experience on the slingshot shock machine. Several modifications were made to correct shortcomings of the original design and to extend the capabilities of the machine. A major portion of the testing was in support of a shock hardening program on a military emergency communication system. Shock levels exceeded 10,000 g—which required several techniques to obtain a satisfactory fragility level. These techniques included determination of fragility of realistically mounted components, evaluation of various component mounting techniques, selective orientation and location of susceptible components, design of chassis structure to take advantage of relative minimums in the measured shock spectrums, and resilient isolation of components which could not be shock hardened in any other way. Author

N70-13302# Sandia Corp., Albuquerque, N. Mex. Optical and Detection Div.
UNATTENDED SEISMOLOGICAL OBSERVATORY Development Report
Jun. 1969 156 p
(ARPA Order 611; Proj. Velauniform)
(SC-M-69-403) Avail: CFSTI

Three seismological observatories were designed to operate unattended for periods up to 120 days and were installed near Fairbanks, Alaska, at the Uinta Basin Seismic Observatory, near Vernal, Utah, and on Sandia Base, Albuquerque, New Mexico. Design of the Unattended Seismological Observatories, installation procedures, and a preliminary approach for tamperproofing the system are presented. Author (NSA)

N70-13424# Ohio State Univ., Columbus. Dept. of Geodetic Science
ADVANCED PHOTOGRAMMETRIC TECHNIQUES FOR HIGHWAY INTERCHANGE GEOMETRY Final Technical Report, Mar. 1967–Jan. 1969
Kailash C. Chopra Jan. 1969 286 p refs Sponsored in part by Ohio Dept. of Highways
(PB-185825; DGS-120) Avail: CFSTI CSCL 13B

The highlight of the report is a description of an application of LSM to the problems of designing, staking and constructing highway interchanges. For design, the investigator's system, using LSM, gives complete information about the alinement, such as, curve lengths, central angles, deflection angles, tangents, azimuths of tangents and radii, stationing and coordinate values for various points. For staking, the LSM approach can give the plane coordinates of any point on the adjusted road or ramp alinement; and the coordinate information can be used subsequently in computing the horizontal angles for staking purposes. For construction, the LSM approach, in conjunction with photogrammetry, can be used for checking construction accuracy of interchange ramps. Author (USGRDR)

N70-13860# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
NEW HYPERSONIC GUN TUNNEL AT KYOTO UNIVERSITY
G. Kamimoto, T. Kimura, H. Matsui, Y. Uenaka, and A. Tsukamoto Dec. 1968 24 p refs
(CP-22) Avail: CFSTI

Theoretical and performance data of a pilot gun tunnel were used to construct a large sized hypersonic gun tunnel. In this paper, its mechaniams and performance are discussed. Author

N70-13862# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
PISTON DRIVEN SHOCK TUBE AT KYOTO UNIVERSITY
G. Kamimoto, T. Akamatsu, K. Teshima, H. Matsui, H. Shirai et al Dec. 1968 14 p refs
(CP-23) Avail: CFSTI

This paper gives the detailed description of the piston driven shock tube and some results of its performance tests. The compression processes are studied experimentally and compared with the theoretical prediction. The shock speed and the flow duration time are measured by electrostatic probes. The Mach numbers of up to 24 in air at the initial pressure of 0.09 ≈ 10 mmHg and the flow duration times of 20 ≈ 150 microns are obtained. Author

N70-13668# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genèse (Belgium).
THE LONGSHOT FREE-PISTON CYCLE. PART 1: THEORY
K. R. Enkenhus and C. Parazzoli Nov. 1968 70 p refs
(VKI-TN-51) Avail: CFSTI

An approximate analytical solution is presented for the free-piston cycle in the VKI Longshot Hypersonic Tunnel. The Longshot differs from a conventional gun tunnel in that a heavy piston is used to compress the nitrogen test gas, which is then trapped at the end of the barrel at very high pressure by the closing of a system of check valves as the piston rebounds. Real gas effects are accounted for by assuming that the nitrogen behaves as a Van der Waals gas with variable specific heats. Author (ESRO)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-12705*# City Coll. of the City of New York.
EXPERIMENTAL DETERMINATION OF PRESSURE DROP AND FLOW CHARACTERISTICS OF DILUTE GAS-SOLID SUSPENSIONS
Salvatore J. Rossetti and Robert Pfeffer 1 Oct. 1969 251 p refs
(Grant NGR-33-013-029)
(NASA-CR-72624) Avail: CFSTI CSCL 20D

The effect of solids loading ration, glass particle size, and air Reynolds numbers on the pressure drop and flow characteristics of a dilute air-solid suspension in turbulent pipe flow has been studied experimentally. The phenomenon of drag reduction has been found to occur for certain particle loadings and particle sizes in both vertical and horizontal flow. An explanation based on the interaction of the particle with the turbulent structure of the fluid in the vicinity of the wall has been suggested. Author

N70-12724# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
FLOW PAST A PLATE SITUATED NEAR A SOLID GROUND-PLANE
G. S. Lipovoi 2 Sep. 1969 13 p refs Transl. into ENGLISH from Gidrodinam. Bolshikh Skorostei (USSR), No. 11, 1965 p 33-40
(Contract NOw-62-0604-c)
(AD-693367; APL-CLB-3-T-599) Avail: CFSTI CSCL 1/3

The ground effect on a slender wing operating at various angles of attack in a flow of an ideal incompressible fluid is discussed. The problem is reduced to flow past two profiles (the primary and image systems) situated symmetrically with respect to the ground. A solution is obtained by the method of vortex sheets. Author (TAB)

N70-12743# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Space Engineering.
A STUDY OF THE MECHANISMS OF GAS SOLID SUSPENSION, HEAT TRANSFER, AND FRICTION FACTOR
Richard L. Peskin and Richard Briller Jan. 1969 149 p refs
(Contract AT(30-1)-2930)
(NYO-2930-14; TR-123-MAE-F) Avail: CFSTI

A theory is presented which describes the heat transfer and friction factor changes which occur in a gas solid suspension as compared with pure gas flow. The theory introduces three variables, the particle number density, a laminar boundary layer in pure gas flow, and a P.D. particle penetration depth into the boundary layer. The penetration depth is a measure of the degree of agitation a single particle causes the boundary layer by penetrating it. The Nusselt numbers and friction factors are correlated. The theory has four significant advantages over previous correlations. It is mechanistic in nature, which represents a novel approach to this problem. It correlates the data from widely varying experiments onto a single line. The theory is used to demonstrate minimum values. The theory also provides physical insight into the boundary layer mechanisms which govern the transport processes and explains such well-known phenomena as the trend toward equality of suspension and pure gas heat transfer at high Reynolds numbers and the decrease in improvements in heat transfer as particle size increases. Author (NSA)

N70-12793# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
THE DIRECT MEASUREMENT OF MOLECULAR VELOCITY DISTRIBUTION FUNCTION Final Technical Report, 1 Feb. 1966 - 1 Feb. 1969
E. P. Muntz 18 Jun. 1969 135 p refs
(Contract AF 49(638)-1526)
(AD-693331; AFOSR-69-2010TR) Avail: CFSTI CSCL 20/4

The basic thrust of the research was the development and application of a technique for measuring molecular velocity distribution functions. The electron beam fluorescence technique for measuring distribution functions in helium was perfected. The technique was applied to the study of a rapidly expanding flow and a normal shock wave. A study of the flow from an evaporating surface was initiated. Related studies of the rarefraction of exhaust plume boundaries were also undertaken. TAB

N70-12858# Argonne National Lab., Ill.
PRESSURE RECOVERY OF A ONE-COMPONENT TWO-PHASE FLOW IN A TWO-DIMENSIONAL DIFFUSER
Hugo P. Korstanje Jan. 1969 72 p refs
(Contract W-7405-eng-38)
(ANL-7504) Avail: CFSTI

Performance characteristics were studied and efficiency data were obtained for one-component two-phase-flow diffusers with an area ratio of two. The optimum pressure recovery for these diffusers was reached with an angle of divergence of 15 deg for void fractions greater than 20 per cent. This phenomenon and the rapid decrease of the efficiency with increasing void fraction and mass flowrate are explained with the hypothesis that the boundary-layer thickness in a two-phase flow is dependent on the void fraction. For a mass flowrate of 0.46 lb/sec, the optimum efficiencies of the subsonic diffuser were 70, 64, and 51 per cent for void fractions of 20, 40, and 60 per cent, respectively. For a mass flowrate of 1.26 lb/sec, the efficiencies were 58, 31, and 8 per cent for void fractions of 20, 40, and 50 per cent, respectively. Author (NSA)

N70-12859# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
EXPERIMENTAL INVESTIGATION OF NON STEADY FORCES ON HYDROFOILS OSCILLATION IN HEAVE Final Report
Raymond K. De Long and Allan J. Acosta Mar. 1969 137 p
(Contract N00014-67-A-0094)
(AD-693315) Avail: CFSTI CSCL 13/10

Measurements of the unsteady forces on heaving delta wing hydrofoils hydrofoils having apex angles of 15 and 30 deg were carried out in fully wetted flow, planing at a free surface, and with forced ventilation. The fully wetted dynamic measurements were in good agreement with the results of lifting surface theory at small angles of attack. A slender body theory of planing due originally to Tulin is extended to account for non-steady motions. This theory generally underestimates the in-phase lift force; the quadrature unsteady lift is well predicted by the theory. Additional

measurements of steady planing delta wings were carried out; for small apex angles and small angles of attack the theory is found to be adequate though it does appear to underestimate the lift somewhat. Some additional experiments on non-steady forces on two-dimensional fully wetted and fully cavitating hydrofoils were also carried out.
Author (TAB)

N70-12864# United Kingdom Atomic Energy Authority, Harwell (England).
FREQUENCY AND VELOCITY MEASUREMENTS OF DISTURBANCE WAVES IN ANNULAR TWO-PHASE FLOW
G. F. Hewitt and P. C. Lovegrove Apr. 1969 23 p refs
(AERE-R-4304) Avail: CFSTI

Velocity frequency data are reported for the disturbance waves in upwards annular two phase air–water flow in a vertical tube. The data were obtained using a combination of high speed cinephotography and film thickness recording using conductance probes. The main object of the experiments was to resolve differences which had appeared in the earlier data on wave frequency. It is concluded that these differences probably arise from the definition of the disturbance waves. It was also shown that the disturbance wave forms a complete ring around the circumference of the tube.
Author (NSA)

N70-12881# Los Alamos Scientific Lab., N. Mex.
THREE-DIMENSIONAL STUDY OF FLOW BETWEEN CONCENTRIC ROTATING CYLINDERS
Kenneth A. Meyer Jul. 1968 12 p refs
(Contract W-7405-eng-36)
(LA-4202) Avail: CFSTI

The wavy vortex mode of flow between concentric rotating cylinders is studied, using a combination of Fourier analysis and finite differencing. Series expansions are introduced into the full Navier–Stokes equations. The resulting time-dependent partial differential equations, obtained by separating the various harmonics, are solved by finite differencing. Numerical results were obtained at Reynolds numbers of 750, 1000, and 2000 at a radius ratio (of outer to inner cylinder) of 1.2. The growth rates of small three-dimensional disturbances are obtained for a laminar base flow and a Taylor-cell base flow. Azimuthal wave velocities for small-disturbance cases and the fully established wavy mode case are obtained, and agree with linear stability calculations and experiment. The effect of the three-dimensional motion (at constant axial wave number) on the torque is examined and appears to be small. The effect, on torque, of varying axial wave number is reconsidered, and it is suggested that this is the predominant mechanism that affects the torque in the wavy mode regime.
Author (NSA)

N70-12939# Brown Univ., Providence, R.I. Div. of Engineering.
RADIATIVE IONIZATION PATTERNS IN COLD PRECURSOR OF AXISYMMETRIC DETACHED SHOCK
Anthony N. Pirri and Joseph H. Clarke Jul. 1969 44 p refs
(Contract Nonr-562(35))
(AD-693492; TR-23) Avail: CFSTI CSCL 20/4

Radiative ionization patterns in the precursor of the shock preceding a blunt body immersed in a hypersonic monatomic gas flow are obtained. Based on earlier work that provides for the uncoupling of the radiative transfer from the gas dynamics, a plausible model of the shock structure and shock layer radiation is proposed. The rate equation for the production of electrons in the precursor is dependent only upon photon absorption because ionizing and neutralizing collisions are negligible; it is solved in the near precursor where one-step radiative ionization dominates. Geometrical complexities introduced by the multidimensional shock are encountered along with the spectral difficulties associated with nonequilibrium radiative ionization. Spatial calculations for the degree of ionization in argon throughout the near precursor are presented for a downstream degree of ionization on the stagnation streamline of 0.8, an upstream temperature of 300K, and an upstream pressure of .001 atm. Intriguing patterns of constant electron density reveal a concentric sphericity effect close to the shock axis of symmetry. In addition, asymptotic solutions illustrate the failure of a radiative point source description of the shock layer to yield accurate solutions off the axis of symmetry.
Author (TAB)

N70-12964# Joint Publications Research Service, Washington, D.C.
THERMAL BUCKLING OF PLATES AND CURVED SHELLS IN SUPERSONIC GAS FLOW
V. V. Bolotin 26 Nov. 1969 42 p refs Transl. into ENGLISH from the book 'Raschety Na Prochnost.' no. 6 Moscow, State Sci.-Tech., 1960 p 190–216
(JPRS-49331) Avail: CFSTI

A derivation of the general equations describing the thermal deformation of plates and curved shells in gas flow is presented. Excessive gas pressure is introduced according to the known theory for supersonic flows. The equations obtained are used for the investigation of heated plane and curved panels, in the postcritical stage, taking into account the nonlinear boundary conditions, and excessive gas pressure which is dependent on the deformation of the surface around which the gas flows.
Author

N70-13006# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONEQUILIBRIUM DISSOCIATION IN A FREE SHEAR (JET) BOUNDARY LAYER
L. I. Vereshchagina-Myshkova 2 Jun. 1968 6 p refs Transl. into ENGLISH from Mat., Mekh. Astron., no. 13, 1969 p 88–93
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The dissociation and the viscous interaction in the near-wake behind hypersonic bodies are discussed using a diatomic model. The mathematical model is developed, and calculations are presented in graph form of the dependence of the ratio between dissociation and recombination, and of the velocity, temperature, and mass concentration profiles in a free shear boundary layer. It was found that the influence of nonequilibrium gas dissociation on the flow parameters in the mixing layer is insignificant.
N.E.N.

N70-13086*# North Carolina State Univ., Raleigh.
CORRECTION OF PRESSURE DATA FOR THERMAL TRANSPIRATION EFFECTS IN PNEUMATIC LINES
James A. Daggerhart Washington NASA Dec. 1969 43 p refs
(Grant NGR-34-002-036)
(NASA-CR-1489) Avail: CFSTI CSCL 20D

The thermal transpiration effect, or the existence of a pressure gradient along the length of a capillary tube in the presence of a temperature gradient, was experimentally examined for three capillary tubes. Length-to-diameter ratios of 43, 80, and 100 were examined. Stainless steel capillary tubes were used to simulate the conditions found in wind tunnels operated at low densities. The test conditions ranged from continuum to free molecular flow, relative to the capillary tube, and in each flow regime the theoretically expected limits were found. An empirical equation proposed by Liang is compared to the present results and found to be a valuable tool in predicting the transpiration effect in capillaries. Correction charts, based on Liang's equation, are presented and examples of their use in various situations are given. The effects of capillary tube conductance and cleanliness on the time required to establish a condition of equilibrium throughout the capillary are also examined.
Author

N70-13148# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Aachen (West Germany).
SONIC BOOM OF BODIES OF REVOLUTION
K. Oswatitsch *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 11 p refs (See N70-13137 03-02)
Avail: CFSTI

This paper briefly outlines recent work on the sonic boom problem. The problems treated with the aid of an analytic method of characteristics are: (1) sonic boom generated by inclined and non-inclined bodies of revolution moving at a constant supersonic speed, (2) sonic boom generated by a non-inclined body of revolution moving at an increasing or decreasing transonic speed, and (3) influence of the isothermal stratification of the atmosphere on the sonic boom. It turns out that the widely used asymptotic formulas are unsatisfactory at altitudes of practical importance. Author

N70-13205# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONEQUILIBRIUM VISCOUS SHOCK LAYER ON A BODY WITH ARBITRARY CATALYTIC ACTIVITY OF THE SURFACE
L. A. Ladnova [1969] 9 p refs Transl. into ENGLISH from Vestn. Leningrad Univ. Math.-Mech. (Leningrad), no. 13, 1969 p 105–112
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Vibrational and dissociational relaxation processes influencing the hypersonic laminar flow around an axisymmetric blunt body are studied utilizing a thin shock layer model. The effects of both nonequilibrium excitation on the chemical reaction rates, and mean vibrational energy changes in the molecules due to chemical reactions are included in the equations. Energy, diffusion, continuity, and momentum equations are combined in a coordinate system and solved by iterative methods allowing computations to the second or third approximation. Heat flux calculations for chemical reactions, which are a function of pressure on surfaces with differing catalytic activity in a binary mixture model, were also applied to a ternary mixture model. It is shown that heat fluxes to the body surface computed for binary and ternary mixtures differ by not more than 7%. M.H.E.

N70-13209# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON FINDING THE CRITICAL VELOCITIES FOR NONSYMMETRIC SUPERSONIC GAS FLOW AROUND PLATES AND SHELLS
A. A. Izmailov 26 Nov. 1968 4 p refs Transl. into ENGLISH from Math.-Mech., no. 5, 1969 p 73–76
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Stability problem formulation, using the piston theory, was investigated for plates and shells in a supersonic gas flow. Homogeneous and inhomogeneous boundary conditions were reduced to finite transcendental equations. Solutions to boundary layer stability problems were obtained using integral equations, Green's function, and Euler formulations. J.A.M.

N70-13283# Harvard Univ., Cambridge, Mass. Engineering Sciences Lab.
TURBULENT FLOW DRAG REDUCTION AND DEGRADATION WITH DILUTE POLYMER SOLUTIONS
Robert W. Paterson Jun. 1969 201 p refs
(Contract N00014-67-A-0298)
(AD-693306) Avail: CFSTI CSCL 20/4

The purpose of the study was to attempt to find an explanation for the phenomenon first reported by Toms in 1948 in which the addition of a few grams of a long chain polymer to a million cubic centimeters of a Newtonian solvent caused a large decrease in the turbulent pipe flow pressure drop while causing only a small increase in the laminar flow viscosity. This phenomenon, which has been observed to occur for a number of different polymers and solvents, is commonly referred to as drag reduction with dilute polymer solutions or the Toms phenomenon. Author (TAB)

N70-13313# Scientific Translation Service, Ann Arbor, Mich.
HYDROGEN IN METALS AS AN EXAMPLE OF A LATTICE GAS WITH PHASE TRANSITIONS: STATIC AND DYNAMIC CRITICAL PHENOMENA
G. Alefeld [1969] 40 p refs Prepared for Oak Ridge National Lab. Transl. into ENGLISH from Kernforschungsanlage, (Juelich), Nov. 1968
(ORNL-TR-2175; JUL-561-FN) Avail: CFSTI

Metal-hydrogen systems offer a series of experimentally attractive groups of problems in connection with the structure, the states of mobility, and the critical phenomena of a lattice gas or a lattice liquid. In these systems in particular it should be possible to advantageously combine microscopic investigation methods, such as the relaxation and resistance measurements, or using microscopic methods such as neutron scattering or nuclear resonance. Phase diagrams and solubility measurements are discussed on the basis of which conclusions were drawn regarding the existance of liquid-like phases in a solid body. The similarity between the lattice gas and a free gas is emphasized, however the essential differences between lattice gas and free gas are discussed. The extent of the quantum effects corresponding to the statistics involved at low temperatures is discussed in the case of lattice liquids such as hydrogen, deuterium, and tritium. NSA

N70-13315# Sandia Corp., Albuquerque, N. Mex.
SOLUTION OF THE NONSTATIONARY BOUNDARY LAYER EQUATIONS BY A DIFFERENCE METHOD [RESHENIE URAVNENII NESTATSIONARNOGO POGRANICHNOGO SLOYA RAZNOSTNYM METODOM]
V. M. Paskonov and N. V. Rabinkina 29 Sep. 1969 11 p refs Transl. into ENGLISH from Vychislitelnyi Tsentr. Sb. Rabot, (Russia), no. 4, 1965 p 130–138
(PB-186101T; SC-T-69-1045) Avail: CFSTI CSCL 20D

The article proposes a difference method for a numerical integration of a system of equations of a nonstationary boundary layer, and for the sake of an example we adduce the solution of a problem regarding a nonstationary boundary layer in a compressible gas on a plate whose temperature varies with time. Author (USGRDR)

N70-13323# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
IMPROVED NUMERICAL TECHNIQUES AND SOLUTION OF A SEPARATED INTERACTION OF AN OBLIQUE SHOCK WAVE AND A LAMINAR BOUNDARY LAYER Final Report
Victor J. Skoglund and Ben Douglas Gay Jun. 1969 157 p Sponsored in part by AEC
(PB-186387; ME-41(69)S-068) Avail: CFSTI CSCL 01A

Initial, boundary and differencing techniques of numerical gas dynamics were improved, and a separated interaction of an oblique shock wave and a laminar boundary layer was solved numerically. The computing time of a Lax–Wendroff differencing technique was reduced 60 percent by making algebraic changes. Inflow and wall boundary techniques were improved, and the new techniques were verified by satisfactory solutions of plain laminar boundary layers and unseparated interactions of oblique shock waves and laminar boundary layers. The new differencing technique was numerically unstable for separated interactions. A stable solution was obtained for a separated interaction of an oblique shock wave and a laminar boundary layer by adding stabilizing terms to the Lax–Wendroff difference equations. Author (USGRDR)

N70-13346# National Bureau of Standards, Boulder, Colo.
TWO-PHASE TWO-COMPONENT CRITICAL FLOW IN A VENTURI
R. V. Smith, L. B. Cousins, and G. F. Hewitt Dec. 1968 57 p Prepared in cooperation with UK Atomic Energy Authority
(PB-186350; R-518; AERE-5736) Avail: CFSTI CSCL 14B

The purpose of this study was to establish a functional relationship between the primary flow variables at, and just upstream of, the point of critical or choking flow for a liquid-gas mixture. The primary variables were pressure, mass flowrate, quality

(i.e. ratio of gas mass flow to total mass flow), and the geometry of the flow channel. Experimental and analytical work are reported for air–water flow in a converging–diverging annular venturi with critical and near-critical conditions at the throat. Pressure tappings were placed at regular intervals along the straight outer wall of the venturi and, since the profiled inner core could be moved axially, accurate pressure data could be obtained in the region of the throat where the pressure gradients were very steep.
Author (USGRDR)

N70-13359# Sandia Corp., Albuquerque, N. Mex.
NUMERICAL STABILITY OF THREE-DIMENSIONAL BOUNDARY LAYER SOLUTIONS
E. Krause et al Oct. 1969 8 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (East Ger.), v. 48, no. 8, 1968 p T205–T208
(PB-186348T; SC-T-69-1048) Avail: CFSTI CSCL 01A

A different method was published which admits transverse components of any size, but which is limited as regards its stability of direction. The method becomes unstable when the direction of the velocity vector deviates by more than 45 deg on either side from the x axis of the system of coordinates. The present paper shows on the basis of stability considerations for the linearized difference equations how the above mentioned limit of 90 deg can be expanded to 135 deg. This augments considerably the stability region of the integration method. The possibility is discussed of an absolutely stable difference scheme, and the results of the stability investigations were verified with the aid of numerical calculations.
Author (USGRDR)

N70-13373# British Steel Corp., London (England). Midland Group.
ELLIOTT 803 STATISTICAL PROGRAMS. PART 4: MULTIPLE REGRESSION ANALYSIS WITH COMPARISON BETWEEN GROUPS (PRS 12)
Robin E. Day 1969 7 p refs
(PB-186294; PZ.004/S.5217/3/C) Avail: CFSTI CSCL 09B

The program carries out multiple regression on comparable batches, (or groups) of data. The regression is first carried out on each separate batch, then the same regression is performed on the pooled data. Parallel equations are then obtained, for each batch, and the significance of the variation between each equation analyzed.
Author (USGRDR)

N70-13428# Boeing Scientific Research Labs., Seattle, Wash.
TWENTY YEARS OF TRANSONIC FLOW
Julian D. Cole Jul. 1969 43 p refs Presented at the AIAA Meeting, San Francisco, 16 Jun. 1969
(AD-694337; D1-82-0878) Avail: CFSTI CSCL 20/4

A brief historical survey leading to problems of current interest is given. The problem of thin three dimensional lifting wings is formulated on the basis of transonic small-disturbance theory. Various overall integral formulas and similarity laws for lift and drag are discussed. The problem of plane mixed flow past an airfoil is set up and the far field discussed. Remarks are made about computation methods and the role of exact hodograph solutions.
Author (TAB)

N70-13449# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
TWO-PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES Quarterly Progress Report, 1 Oct.–31 Dec. 1968
Feb. 1969 23 p ref
(Contract AT(03-4)-189)
(GEAP-10009; QPR-13) Avail: CFSTI

The nine-rod test section which was built specially for sub-channel and flow structure measurements is described. Results of measurements of the velocity profile at inlet to test length are given. On the basis of these measurements, the honeycomb flow straighteners initially installed ahead of the channel inlet were removed.
Author (NSA)

N70-13478*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID INFLOW TO PARTIALLY FULL, HEMISPHERICAL-ENDED CYLINDERS DURING WEIGHTLESSNESS
Eugene P. Symons Washington Dec. 1969 20 p refs
(NASA-TM-X-1934) Avail: CFSTI CSCL 20D

The behavior of the liquid-vapor interface during liquid inflow to a hemispherical ended cylinder during weightlessness was observed. The tank was partially full of liquid at the initiation of inflow, and the investigation was limited to two tank radii, one inlet line radius, and two liquids (trichlorotrifluoroethane and ethanol). Both a stable region and an unstable region of interface behavior were noted. Results indicate that the interface becomes unstable above a critical inflow velocity. This critical inflow velocity appears to remain constant for a given liquid until a certain initial liquid height has been exceeded. At initial liquid heights larger than this value, the critical inflow velocity increases slightly. The rate of increase was larger for ethanol than for trichlorotrifluoroethane.
Author

N70-13543# Air Force Academy, Colo. Frank J. Seiler Research Lab.
USE OF TIME RESOLVED RAMAN SCATTERING FOR THE MEASUREMENT OF DISSOCIATION RATES IN A SHOCK TUBE
Robert W. Milling 9 Jun. 1969 34 p refs
(AD-694481; SRL-69-0005) Avail: CFSTI CSCL 20/4

The use of Raman scattering as a diagnostic tool for measuring gaseous relaxation rates in a shock tube is investigated. The theory of Raman scattering is reviewed and the application to shock tube measurements is developed. Results of an experiment are discussed. While a Raman signal was detected it is concluded that additional development is required before this technique may by applied successfully.
Author (TAB)

N70-13567*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
INVESTIGATIONS AND ANALYSIS OF FLOW PHENOMENA IN AXIAL FLOW INDUCERS Semiannual Progress Report
A. Poncet and B. Lakshminarayana Oct. 1969 63 p refs
(Grant NGL-39-009-007)
(NASA-CR-107267) Avail: CFSTI CSCL 20D

The three bladed inducer showed better performance than the four bladed inducer tested at the same flow coefficient. Skin friction coefficient and turbulent intensity measurements were also made inside the boundary layer of a rotating helical blade. Design performance, theoretical considerations, and stationary probe and three dimensional instantaneous velocity measurements at the three bladed inducer exit were studied. Results are (1) Stagnation and static head rise are higher than those of the four bladed inducer at all radii. (2) Axial velocity profiles show a deterioration from that of the four bladed inducer. (3) Agreement between the predicted values of the axial velocity and the measured values is good. (4) There is no difference in absolute tangential velocities measured at the exit of the two inducers. (5) There is an improvement in hub wall and annulus wall static pressure distribution. (6) The sensing and data processing equipment for measuring the instantaneous three dimensional flow field at the inducer exit is operational.
J.A.M.

N70-13650# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
CONSIDERATION OF SIMULATION PARAMETERS FOR BLUNT THICK BODIES IN RAREFIED HIGH-SPEED FLOWS Final Report, 1 Feb.–30 Jun. 1968

J. Leith Potter and John T. Miller Nov. 1968 25 p refs Prepared by ARO, Inc.
(Contract F40600-69-C-0001)
(AD-678159; AEDC-TR-68-242) Avail: CFSTI CSCL 20/4

The current use of several different dynamic simulation parameters for correlating bluff body drag coefficient data is reviewed in terms of the need for a parameter which is both effective and does not contain any quantities whose values are uncertain in hypervelocity real gas nonequilibrium flows. Such a nondimensional number or parameter is suggested and its effectiveness for correlating a variety of both previously published and new sphere drag data is assessed. Author (TAB)

N70-13681# Argonne National Lab., Ill.
PROBLEM OF THE ONSET OF NUCLEATE BOILING IN FORCED LIQUID FLOW [K VOPROSU O NACHALE PUZYRKOVOGO KIPENIYA V VYNUZHDENNOM POTOKE ZHIDKOSTI]
N. V. Aleksandrov Aug. 1969 12 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 16, no. 5, 1969 p 804–810
(PB-185862T; ANL-Trans-765) Avail: CFSTI CSCL 20D

The possibility of onset of bubble boiling in a forced fluid flow is considered. Equations are obtained for calculation of the minimum temperature difference between the wall and fluid in the flow. The limits of application of the above relationships are defined. Author (USGRDR)

N70-13687# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
STUDY OF A TRANSONIC FLOW WITH CHEMICAL REACTIONS BY THE SMALL PERTURBATION METHOD: ONE- AND TWO-DIMENSIONAL PROBLEM [ETUDE D'UN ECOULEMENT TRANSSONIQUE AVEC REACTIONS CHIMIQUES PAR LA METHODE DES PETITES PERTURBATIONS: PROBLEME UNI ET BIDIMENSIONNEL]
Roger Prud'homme 1969 29 p refs In FRENCH; ENGLISH summary Presented at the 2nd Colloq. on the Gas Dyn. in Explosions and Reaction Systems, Novosibirsk, USSR, 24–29 Aug. 1969 Submitted for publication
(ONERA-TP-749) Avail: CFSTI

In this paper the transonic quasi-one-dimensional equations of a flow with chemical reactions are established and solved. Particular solutions of these equations are examined for such a flow when it is two-dimensional. The method used to write these equations is that of the singular small perturbations around a uniform flow in chemical equilibrium. Author (ESRO)

N70-13683# Naval Ordnance Lab., White Oak, Md.
HOW TO ANALYZE 2-D SCHLIEREN PHOTOGRAPHS TO OBTAIN THE DENSITY GRADIENT STRUCTURE OF 3-D FLOW FIELDS Final Report
Allen E. Winkelmann and Robert H. Feldhuhn 15 Apr. 1969 34 p refs
(AD-694469; NOLTR-69-80) Avail: CFSTI CSCL 20/4

A technique is outlined by which density gradients visible in two-dimensional schlieren photographs can be analyzed to obtain the density gradient structure—i.e., the shape and location of density gradients such as shock waves and vortices—of three-dimensional flow fields. Practical application of the technique relies on obtaining a series of schlieren photographs of the flow field from different viewing orientations. The analysis is specialized to the case of a right-circular cone at angle of attack. Results are presented which show the shape and location of the bow shock of a 5 deg half-angle right-circular cone at a nominal Mach number of 5.0, a nominal free-stream Reynolds number per foot of 4,800,000 and angles of attack equal to 15 and 40 deg. Author (TAB)

N70-13704# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
THE INFLUENCES OF HALL EFFECT AND WALL CONDUCTIVITY ON MAGNETOHYDRODYNAMIC COUETTE FLOW
P. Massee Dec. 1967 76 p refs
(VTH-148) Avail: CFSTI

In this report the influences of Hall effect and wall conductivity on MHD Couette flow are studied. Under the present assumptions even negative values of the velocity component U sub x appear in some cases. It is concluded that it will be of importance to study the influence of Hall effect and wall conductivity also in two-dimensional magnetohydrodynamic channel flows. Author (ESRO)

N70-13714# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
PERTURBATION METHODS FOR LAMINAR FLOW STUDY: APPLICATION TO THE LEADING EDGE PROBLEM [EMPLOI DES METHODES DE PERTURBATION POUR L'ETUDE DES ECOULEMENTS LAMINAIRES: APPLICATION AU PROBLEME DU BORD D'ATTAQUE]
Claude Francois 1969 22 p refs In FRENCH; ENGLISH summary Presented at the 9th Bien. Symp. on Probl. and Advan. Methods of Fluid Mech., Kazimierz, Poland, 1–7 Sep. 1969 Submitted for publication
(ONERA-TP-757) Avail: CFSTI

This paper aims at establishing all the possible simplified forms of the Navier-Stokes equations which in the first approximation are valid for describing the laminar bi-dimensional flows of a viscous incompressible fluid, and for writing systematically the matching conditions between two domains described by different approximations. The results are applied to a number of examples in particular that of the near wake and the last part is devoted to the flow around a leading edge. Author (ESRO)

N70-13715# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
CONTRIBUTION TO THE STUDY OF DYNAMIC AND THERMAL PHENOMENA AT REATTACHMENT OF A SUPERSONIC JET ON A CYLINDRICAL SURFACE [CONTRIBUTION A L'ETUDE DES PHENOMENES DYNAMIQUES ET THERMIQUES AU RECOLLEMENT D'UN JET SUPERSONIQUE SUR UNE SURFACE CYLINDRIQUE]
Jean Delery and Pierre Rougier (Ph.D. Thesis–Lyon Univ.) 1969 22 p refs Presented at the Intern. Seminar on Heat and Mass Transfer in Separated Flows, Herceg-Novi, Yugoslavia, 1–13 Sep. 1969 Submitted for publication
(ONERA-TP-758) Avail: CFSTI

This paper presents the results of an experimental study of the turbulent reattachment of a supersonic axisymmetric jet upon a cylindrical wall in air. The first part concerns the study of the dynamic phenomena in the adiabatic case. In particular, the existence of a correlation of the recompression curves in the zone of reattachment is shown. The second part deals with the thermodynamic phenomena in the event of the reservoir temperature being well in excess of the wall temperature. An examination of the influence of temperature upon cavity pressure is followed by a detailed analysis of the distribution of heat-flux in the zone of reattachment. Author (ESRO)

N70-13719# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
THERMAL PROTECTION OF MODELS DURING FLOW BUILD-UP IN AN INTERMITTENT WIND TUNNEL
Christian Soulier 1969 8 p Presented at the 32nd Meeting of the Supersonic Tunnel Assoc., Stockholm, 18–19 Sep. 1969 Submitted for publication
(ONERA-TP-755) Avail: CFSTI

The S3MA intermittent wind tunnel at the ONERA Test Centre of Modane-Avrieux (France) is amenable to the Mach number values 2, 3.4, 4.5, and 5.5 at a stagnation temperature of 570°K. Failing a device for launching it into the wind, the model

is exposed to the processes of flow build-up. In order to shield it from the attendant effects, a model protecting device has been designed and developed in a series of kinetic heating tests.
Author (ESRO)

N70-13724# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.
COMPUTATION OF SHOCK-FREE TRANSONIC FLOWS FOR AIRFOIL DESIGN
David G. Korn Oct. 1969 101 p refs
(Contract AT(30-1)-1480)
(PB-186124; NYO-1480-125) Avail: CFSTI CSCL 01C

Steady shock-free transonic compressible fluid flow about a series of symmetric airfoils without circulations is found by computing analytic solutions of the hodograph equations for an ideal polytropic gas in two dimensions.
Author (USGRDR)

N70-13758# Air Force Academy, Colo. Frank J. Seiler Research Lab.
NUMERICAL EXPERIMENTS IN SEMI-GRAY RADIATIVE GASDYNAMICS
David Finkleman 27 Feb. 1969 76 p refs
(AD-694480; SRL-68-0012) Avail: CFSTI CSCL 20/4

A simple model which simulates nongray behavior of real gases is investigated numerically. Equilibrium and nonequilibrium radiative fields are computed both with multi-step spectra and corresponding approximate absorption coefficients. The several hundred cases computed reveal that the approximate method is quite acceptable. The method is applied to the characteristics calculation of the radiation coupled flow field generated by a piston inserted into a quiescent gas. Comparison of two nongray models confirms that the flow field is insensitive to the detailed nongrayness of the gas. It is observed that in nongray gases the inclusion of upstream absorption may lead to hotter but thinner shock layers than computations performed without upstream absorption.
Author (TAB)

N70-13772# National Physical Lab., Teddington (England). Numerical and Applied Mathematics Div.
SHEAR FLOW PAST A SPHERE
R. R. Cousins Sep. 1969 21 p refs
(NPL-Ma-80) Avail: CFSTI

Flow of an incompressible inviscid fluid past a sphere is considered where the flow upstream consists of a slight shear flow superimposed on a uniform stream. Secondary vorticity, produced by deformation of vortex elements as they are carried past the sphere, is determined by a method due to Lighthill. The components of vorticity are calculated from a drift function for which expressions are available in part of the flow field. For the region in which no expansion is valid Lighthill used a rough numerical approximation, but in this paper an exact expression is obtained. A Biot-Savart law is used to determine the secondary flow field by integration. The theory is used to correct measurements of pressure obtained using a pitot tube, so enabling speed and direction of flow to be measured more accurately.
Author (ESRO)

N70-13779# Columbia Univ., New York. Dept. of Applied Science and Engineering.
NORMAL AND TRANSVERSE IONIZING SHOCK STUDIES
R. A. Gross, L. S. Levine, R. J. Meehan, and B. Miller 1969 5 p refs
(Contract AF-49(638)-1634)
(AD-693921; AFOSR-69-2436TR) Avail: CFSTI CSCL 20/4

Recent experimental and theoretical studies of normal and transverse ionizing shocks are summarized. Results of normal ionizing shock studies are reviewed briefly. Transverse ionizing shocks have been observed traveling with speeds and drive currents that are in excellent agreement with a snowplow-type theory. It is noted that small bias fields cause significant shunting of the total discharge current at the launch end of the shock tube while large bias fields inhibit shunting and thereby enhance shock-tube performance. Evidence is presented supporting the hypothesis that this effect is caused by sputtering of heavy-metal vapors from the launch area of the shock tube.
Author (TAB)

N70-13783# Naval Research Lab., Washington, D.C. Chemistry Div.
PRELIMINARY EXPERIMENTS ON DRAG REDUCING AGENTS IN LIGHT WATER CONCENTRATE SOLUTIONS
P. B. Leach and R.C. Little Aug. 1969 16 p refs
(AD-694455; NRL-MEMO-2030) Avail: CFSTI CSCL 13/12

Preliminary experiments indicate that drag reducing agents incorporated in light water concentrates successfully reduce turbulent friction losses of fire-fighting fluids flowing in a pipe.
Author (TAB)

N70-13831# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
POSSIBILITY OF GAS FLOW MEASUREMENTS USING IONIZATION PRODUCED BY RADIOACTIVE SOURCES. PERFORMANCES OBTAINED USING CONTINUOUS AND PULSED IONIZATION [ETUDE DES POSSIBILITES DE MESURE DES DEBITS GAZEUX PAR L'IONISATION CREEE AU MOYEN DE SOURCES RADIOACTIVES. PERFORMANCES OBTENUES PAR IONISATION CONTINUE ET PAR IONISATION PULSEE]
Bruno Toudoire (Ph.D. Thesis--Paris Univ., 12 Nov. 1968) Jul. 1969 166 p refs In FRENCH; ENGLISH summary
(CEA-R-3699) Avail: CFSTI

Two methods for measuring gas flow have been studied, based on the ionization of the fluid by a radioactive source. In the first, called the continuous method, use is made of the relationship between the flow and the ionic density at a point situated down-stream from the ionizing source. In the second method, called 'pulsed', the time for a burst of ions to pass between two points in the circuit is measured. An attempt has been made to predict and to justify theoretically the experimental results, and to determine to what extent these methods can provide absolute measurements or measurements requiring a calibration using known gas flows. These methods are characterized by the absence of moving parts or of parts under reduced pressure and can yield results with an accuracy of between a few per cent to a few tenths of a per cent. The information, provided in either analog or digital form, can be adapted for use in servo-mechanisms or automatic systems. The applications of an industrial type are described; they concern gas-flow measurements in a railway braking circuit, and in tubes of 20 and 30 cm diameter.
Author (ESRO)

N70-13832# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
PITOT BOUNDARY LAYER PROBES WITH POSITION INDICATORS USING EXTENSOMETRIC GAUGES
Jean Laverré 1969 9 p refs Presented at the 32nd Meeting of the Supersonic Tunnel Assoc., Stockholm, 18-19 Sep. 1969 Submitted for publication
(ONERA-TP-754) Avail: CFSTI

The need for a precise exploration of the boundary layers on wind-tunnel test models has led to the improvement of existing instruments. The new device enables the distance between probe and model wall to be measured exactly by observation of the deformation of a flexible metal strip. To prevent the device from interfering with the boundary layer a probe support has been devised passing through the wall under observation, and the probe tip has been designed according to aerodynamic criteria. Industrial-scale testing must be preceded by a check to ascertain whether the new probe introduces any systematic error into the position-finding process through deformations left unrevealed by the position detector system.
Author (ESRO)

N70-13878# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
STREAM FUNCTIONS METHOD FOR CALCULATING STEADY THREE-DIMENSIONAL ROTATIONAL FLOWS OF A COMPRESSIBLE PERFECT FLUID [METHODE DES FONCTIONS DE COURANT POUR LE CALCUL DES ECOULEMENTS TRIDIMENSIONNELS ROTATIONNELS STATIONNAIRES D'UN FLUIDE PARFAIT COMPRESSIBLE]
Radyadour Kh. Zeytounian 1969 36 p refs In FRENCH; ENGLISH summary Presented at the Conf. on Appl. of Numerical Methods in Mod. Gas Dyn., Novosibirsk, USSR, 19–24 Aug. 1969
(ONERA-TP-747) Avail: CFSTI

This article sets out to define some intrinsic characteristics of the rotational steady flow of a compressible perfect fluid in three-dimensional space. Two stream functions psi and chi are introduced enabling Euler's equations to be rewritten in a new form and presented in several variants depending on the nature of the particular flow under consideration. The structure of vortex surfaces and the relations between the stream functions and 'vortex functions' are also explored. The second part deals with certain considerations likely to be relevant to the solution of the derived equations; in particular, it shows the ways and means of computing a quasi-plane rotational flow by introducing the disturbances in the stream functions with reference to a plane flow taken to be known. The use of the difference equation so obtained for computing these disturbances is relatively straightforward and may form the basis of various numerical applications. Author (ESRO)

N70-13933# Institut de Mécanique des Fluides de Lille (France).
ASTIGMATIC USE OF A DIFFERENTIAL INTERFEROMETRIC FITTING WITH A WOLLASTON'S DOUBLE PRISM FOR THE STUDY OF THE THERMAL BOUNDARY LAYER
Gérard Gontier 1969 16 p refs Presented at the Intern. Seminar on Heat and Mass Transfer in Flows with Separated Reg., Herceg Novi, Yugoslavia, 1–13 Sep. 1969 Sponsored by Min. des Armées
Avail: CFSTI

When a differential interferometric device is used, say with a spherical mirror and a Wollaston's double prism to observe and measure the density gradient in a moving gas the optical pieces are usually set up to give the best stigmatism conditions. If a narrow field is to be studied e.g. a boundary layer along a flat plate, the best sensitivity is obtained when the fringes are parallel to the plate but a few of the fringes are then observed in the boundary layer and the measurements are not accurate. The measurements can be improved if the spherical mirror is used in an astigmatic manner whilst ensuring that the images remain clear. Then, maintaining the best sensitivity, one can give the fringes any direction with respect to the displacement between the two separated beams. In such cases the device shows an ease of adjustment similar to that of the conventional Mach-Zehnder fitting. The fringe direction can be kept normal to the plate outside the boundary layer and one can measure the normal gradient of the density accurately. This procedure was used to determine the temperature distribution in the neighbourhood of a vertical plate heated at one end. The interferometric results agree with those obtained with a thin thermal gauge. Author (ESRO)

N70-13938# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AERO (HYDRO) DYNAMIC MODEL FOR CALCULATING RELIEF WAVES [MODELE AERO (HYDRO) DYNAMIQUE POUR LE CALCUL DU REGIME DES ONDES DE RELIEF]
Radyadour Kh. Zeytounian 1969 14 p refs In FRENCH; ENGLISH summary Presented at the AGARD Specialists Meeting on Shear Flow Aerodyn., Munich, 15–17 Sep. 1969
(ONERA-TP-727) Avail: CFSTI

Based on the simplified equations of the convection theory (Boussinesq), various theoretical models are built that may be used for studying peculiarities of the phenomena due to the dynamic action of the relief in a barocline atmosphere, any boundary layer effect being ignored. Some results of the calculation are presented, in particular in on-linear theory, the calculations show the downstream of obstacles a vortex regime (closed streamlines) is established, which leads in many cases to a configuration similar to that of the von Karman vortex street. This vortex regime, characterized by a strong turbulence, is responsible, for a great part of the clear air turbulence phenomenon. Author (ESRO)

N70-13962# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AIR SHOCK AND FLOW IN MODEL ROOMS
George A. Coulter Jun. 1969 437 p refs
(Order DAHC20-67-W-0153)
(AD-693874; BRL-MR-1987) Avail: CFSTI CSCL 19/4

The results of model rooms with entrance baffles and chamber filling are given for two and three-dimensional models exposed to shock waves 5-20 psi overpressure produced in the 5 x 15 inch, 24 inch and 5.5 ft. shock tubes. Additional results are given for a field experiment in which a test structure 8 x 8 x 12 feet size was exposed to a 5 psi overpressure blast wave from the explosion of 500 tons of TNT. The results are presented as pressure-time filling records and high speed photographs to illustrate the shock filling process and the effects from the entrance baffles. A smoke grid technique was used to illustrate the shock filling process. Author (TAB)

N70-13972# Ballistic Research Labs., Aberdeen Proving Ground, Md. Applied Mathematics Div.
COMPRESSION OF POLYTROPIC GASES BY IMPULSIVE PISTON MOTION IN HYPERVELOCITY GUNS, GUN TUNNELS, AND REACTION HEATERS
Ray C. Makino and Viola Woodward Aug. 1969 36 p refs
(AD-693777; BRL-1446) Avail: CFSTI CSCL 14/2

Simple analytic solutions are obtained for the shock compression of polytropic gases in hypervelocity guns, gun tunnels, and reaction heaters, where the piston is given some finite energy impulsively and is constrained to move with a piecewise uniform velocity. Examples are given to show the variation of pressure, density, and temperature with the specific heat ratio of the gas and with the piston-to-gas mass ratio. Author (TAB)

N70-13999# Sud-Aviation, Courbevoie (France).
COMPUTATION OF THE FAR WAKE OF THE REENTRY BODY WITH OR WITHOUT CHEMICAL KINETICS [CALCUL DU SILLAGE LOINTAIN DE CORPS DE RENTREE AVEC OU SANS CINETIQUE CHIMIQUE]
A. Baldacci 1969 49 p In FRENCH Presented at the Sixth Colloq. on Appl. Aerodyn. of the Assoc. Franc. d'Ingr. Tech. de l'Aeron, Toulouse, 12 - 14 Nov. 1969
Avail: CFSTI

The properties of far wakes have been computed using the finite difference method with no assumptions regarding the profiles. Viscosity, thermal conductivity and diffusion have been taken into account, the air being a mixture of eight elements (O2, N2, NO, NO(+), O2(-), O, N and free electrons) interacting with one another according to nine chemical reactions of which four are catalyzed by the elements. The Prandtl and Lewis numbers are assumed to be constant. Integration of the equations has been carried out using an implicit method rather than the explicit one usually used. Turbulent and laminar wakes are also considered. ESRO

N70-14032# Institut de Mécanique des Fluides de Lille (France).
ON THE EXCEPTIONAL GRAVITY WAVE PROPAGATION PHENOMENA IN DUCTED FLOW [SUR DES PHENOMENES EXCEPTIONNELS DE PROPAGATION D'ONDES DE PESANTEUR DANS UN CANAL]

Arthur Dyment 1969 14 p ref In FRENCH Presented at the Natl. Conf. on Appl. Mech., Bucharest, Jun. 1969
Avail: CFSTI

Flow equations for a non-viscous, irrotational flow are discussed and applied to a horizontal cylindrical duct. ESRO

N70-14083# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
EXPERIMENTAL INVESTIGATION ON BOUNDARY LAYER TRANSITION IN HYPERSONIC FLOW [EXPERIMENTELLE UNTERSUCHUNG DES GRENZSCHICHTUMSCHLAGS IN HYPERSCHALL]
Roger Michel and Volker Schmitt 1969 24 p refs In GERMAN Presented at the DGLR 2nd Ann. Meeting, Bremen, 22–24 Sep. 1969 Submitted for publication
(ONERA-TP-737-D) Avail: CFSTI

A systematic study of transition processes at high Mach number is presented. Some experimental methods for determining the boundary layer transition range in hypersonic wind tunnels are described and variations of Reynolds number and Mach number are evaluated. Results are given for flat plates and rotating bodies and it is shown for the latter that the form of the nose cone has an effect that cannot be neglected. Velocity profiles in the boundary layer transition are also discussed. ESRO

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-12710# Bureau of Mines, Minneapolis, Minn.
AN ULTRASONIC METHOD FOR DETERMINING THE ATTENUATION SYMMETRY OF MATERIALS
Thomas R. Bur, Kenneth E. Hjelmstad, and Richard E. Thill Dec. 1969 11 p refs
(BM-RI-7335) Avail: Issuing Activity CSCL 08G

The amplitude of the first peak of an ultrasonic pulse which has traversed the diameter of a sphere is obtained for many directions in the sphere. This amplitude is relative to an input which is held constant for all measurements on a given sphere. Since the boundary conditions, distance of travel, and the controllable experimental factors are constant for all measurements, variations in this amplitude reflect variations in the attenuation or absorption with direction. The data are plotted and contoured as an equal area projection. The attenuation symmetry is the symmetry expressed by the contour pattern. Analysis of the data from several rock types indicates that the amplitude expresses a higher percentage of anisotropy than the velocity. In most cases the attenuation symmetry appears to be of the same system as the elastic symmetry expressed by the velocity. Results are shown for three rock spheres. Author

N70-12765*# GCA Corp., Bedford, Mass. Technology Div.
LABORATORY MEASUREMENTS OF PHOTODETACHMENT CROSS SECTIONS OF SELECTED NEGATIVE IONS Final Report, 27 Jun. 1968–26 Jun. 1969
Peter Warneck Nov. 1969 41 p refs
(Contract NAS5-11157)
(NASA-CR-107168; GCA-TR-69-13-N) Avail: CFSTI CSCL 04A

Laboratory measurements of photodetachment cross sections of negative ions considered important in the D region of the upper atmosphere are reported. An apparatus described previously, employing the radiation generated by a xenon-mercury arc, was improved by the addition of a discharge ion source, and by modifications of the photodetachment chamber configuration. Photodetachment cross sections are given for the ions O(–), H(–), NO2(–), O2(–) and OH(–) at wavelengths from 6200 to 3000A. Photodetachment cross sections for No2(–) are reported for the first time. The observation of photodetachment of CO3(–) and NO3(–) was attempted but no detachment was observed. Conclusions concerning D region photodetachment processes and recommendations for further experiments are given. Author

N70-12771# Wyoming Univ., Laramie. Natural Resources Research Inst.
ENVIRONMENTAL DATA FORMAT STUDY Final Report
John C. Bellamy Aug. 1969 31 p *Its* Inform. Circ. No. 61
(Grant ESSA-E291-68(G))
(PB-185892) Avail: CFSTI CSCL 05B

An analysis of the basic characteristics of all kinds of environmentally-dependent, or earth-centered geospheric operations is presented in order to help provide a sound basis for establishing and implementing a viable ENDEX (or Environmental Data Index) for all kinds of environmental data, and initiating those developments of equipments and procedures with which improved formats of environmental data could better be acquired, processed and utilized. The satisfaction of this dual purpose has been found to consist necessarily of a continual trial-and-error or postulate-and-test interplay between an analytical identification of successively more detailed elements and interrelationships of the overall field of geospheric operations, and particular ways in which particular detailed elements of such geospheric operations might well be synthesized. Author (USGRDR)

N70-12788# Geological Survey, Denver, Colo.
POTENTIAL APPLICATIONS OF NUCLEAR EXPLOSIVES TO THE RECOVERY OF GEOTHERMAL ENERGY Progress Report, For Fiscal Year 1968
Howard H. Waldron Jun. 1969 20 p
(Contract AT(04-3)-289)
(USGS-289-2) Avail: CFSTI

Studies during fiscal year 1968 included some library research and consultations, a brief reconnaissance of the potential of several thermal areas in Oregon, Nevada, and California, and a brief geologic reconnaissance of the Coso Thermal Area in southern California. It was concluded that too little is known at the present time about geothermal heat and energy to permit an adequate evaluation of the feasibility of utilizing nuclear explosives for the recovery of geothermal energy. Research and investigations currently in progress, however, should greatly advance knowledge on geothermal heat and energy within the next few years. Author (NSA)

N70-12791# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
TETHERED BALLOON FOR STUDY OF COASTAL DYNAMICS. WHERE MOST GRAINS OF VERY COARSE SAND AND FINE GRAVEL ARE DEPOSITED
Choule J. Sonu and Richard J. Russell 1969 25 p refs
(Contract Nonr-1575(03))
(AD-693386; TR-66; TR-68) Avail: CFSTI CSCL 8/6

Contents: Tethered balloon for study of coastal dynamics; Where most grains of very coarse sand and fine gravel are deposited. TAB

N70-12847*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MODELS OF EARTH'S ATMOSPHERE (120 to 1000 km) NASA Space Vehicle Design Criteria (Environment)
D. K. Weidner, C. L. Hasseltine, and R. E. Smith May 1969 40 p refs
(NASA-SP-8021) Avail: CFSTI CSCL 04A

A computerized version is presented of a prediction method to provide models of the earth's atmosphere which vary with solar condition and location. The resulting atmospheric models, which are predicted for particular times and locations, provide atmospheric density, chemical composition, temperature, molecular mass, and density scale height between 120 and 1000 km altitude. In addition to the computerized method, a quick-look prediction method is given that may be used to obtain an estimate of atmospheric density for any time and spatial location without the use of a computer. A sample problem illustrates this method. Author

N70-12849# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF PKP SEISMIC WAVES Annual Report, 1 Feb. 1967 – 15 Mar. 1969
William F. Isherwood 15 Mar. 1969 17 p refs
(Contract F44620-67-C-0080; ARPA Order 292-43)
(AD-693340; AFOSR-69-2196TR) Avail: CFSTI CSCL 17/10

A four-element seismic array was established at Byrd Station, Antarctica, for investigation of PKP seismic waves. This seismic station (BYA) has been operating continuously since January 18, 1968. Seismic data are recorded on magnetic tape at a level permitting playback at a system magnification of as high as 500,000. Background ground motion amplitudes at Byrd Station were found to be in the order of 10 millimicrons at the outlying seismometers and frequently of the order of 100 millimicrons at the center seismometer when heavy equipment was operating, nearby. About 2,700 compressional and shear arrivals were reported in the first 8 months of recording, with epicenters ranging over the entire earth. About 400 of these events have been confirmed as PKP arrivals. The epicentral distance for these arrivals ranged from 100 to 173 degrees, with the majority being from the Japanese and Kurile areas. Data from the first full year of operation are now being processed at SRI. The station was turned over to the USC+GS and is currently being operated by that agency. Author (TAB)

N70-12883# Atomic Energy Commission, Idaho Falls, Idaho. Health Services Lab.
INJECTION OF GAS TO THE LITHOSPHERE AT THE NATIONAL REACTOR TESTING STATION
Bruce L. Schmalz comp. Jun. 1969 166 p refs
(IDO-12069) Avail: CFSTI

Tests were conducted by injecting 1 million cu ft of air, containing 1,000 Ci xenon-133, into a porous zone 120 feet below the land surface. The movement of this gas was studied by means of air samples and radiation detection equipment placed in surrounding monitoring wells. Air samples also were collected at the land surface and from strategic locations in the atmosphere. Analysis of the results using diffusion equations verified that the movement could be explained on this basis. Variation of estimated flux from that measured was explained on the basis of barometric influences. It was estimated that 0.5 of 1,000 Ci injected escaped to the atmosphere during a 24-day period. This amount resulted in concentrations that were less than the mean concentration of xenon-133 in the injected air by a factor of 10 to the 8th power. Mathematical models describing the flow by convective forces created by injection also were tested and found adequate for making engineering estimates. Author (NSA)

N70-12900*# National Aeronautics and Space Administration, Washington, D.C.
GEOMETRICAL GEODESY WITH SATELLITES: STATEMENT ON THE 6TH PLAN [GEODESIE GEOMETRIQUE PAR SATELLITES: RAPPORT POUR LE 6e PLAN]
Dec. 1969 6 p Transl. into ENGLISH from French publ.
(NASA-TT-F-12728) Avail: CFSTI CSCL 08E

Current and planned projects for the development of a standard polyhedron to establish the figure of the earth are briefly described. The accuracy obtained with the laser technique is felt to be high, with a geodetic technique to be promising, and with the SECOR and photographic techniques to be considerably less. An outline is presented of the main aspects of the plan to define a localized polyhedron with a limited number of points with maximum precision. N.E.N.

N70-12905# Purdue Univ., Lafayette, Ind.
AERIAL PHOTOGRAPHY AND MULTISPECTRAL REMOTE SENSING FOR ENGINEERING SOILS MAPPING Progress Report on Phase B
Marc G. Tanguay 6 May 1969 362 p refs Prepared in cooperation with Ind. State Highway Comm. and Bur. of Public Roads
(PB-184988; JHRP-13) Avail: CFSTI CSCL 08B

The research investigated color aerial photography and other remote sensing techniques including multispectral imagery and their application to engineering soil mapping. The principal objectives were to study the incremental gain in information through the use of these techniques and to determine the cost savings if any. Other objectives included the investigation of some of the variables influencing the reflectance of materials and their diurnal thermal behavior, as it affects thermal imagery; and the generation of engineering soils maps by computer analysis of digitized multispectral data. USGRDR

N70-12921# Geological Survey, Denver, Colo.
POTENTIAL APPLICATIONS OF NUCLEAR EXPLOSIVES TO THE RECOVERY OF GEOTHERMAL ENERGY Progress Report for Fiscal Year 1965
Howard H. Waldron Jun. 1969 20 p refs *Its* Geothermal Energy-1
(Contract AT(04-3)-289)
(USGS-289-1) Avail: CFSTI

The initial phase of study and the utilization of nuclear explosives for stimulating and beneficiating the recovery of geothermal energy have been directed toward fundamentals that may control or influence the occurrence and character of geothermal areas. Some characteristics of heat flow and of geothermal districts are summarized; the occurrence and distribution in the United States of the more than 1,300 thermal spring localities, indicative of geothermal districts, are reviewed. Future work will include broad regional studies in the Western United States, and detailed studies of one or more selected geothermal districts. Author (NSA)

N70-12926*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF IRREGULAR STRUCTURE IN THERMAL ION DISTRIBUTIONS IN THE DUSK-SIDE MAGNETOSPHERE
H. A. Taylor, H. C. Brinton, and A. R. Deshmukh (Aero Geo Astro Corp.) Dec. 1969 29 p refs Submitted for publication
(NASA-TM-X-63754; X-621-69-519) Avail: CFSTI CSCL 04A

Direct measurements of the distributions of the thermal positive ions H(+) and He(+) in the magnetosphere reveal a distinct variability in the position and structure of the plasmapause. Such variability is observed to be most pronounced in the afternoon-dusk local time sector and is indicative of magnetospheric irregularities in the same region. In particular, the plasmapause was observed at L positions as distant as L = 7-8 in the afternoon-dusk sector, in contrast to positions near L = 5-6 observed near midnight on the same day and at comparable levels of moderate magnetic activity. Both, a dusk-side bulge and fine structure are observed to persist during periods of enhanced magnetic activity. The above variability is superimposed on an average diurnal distribution of the plasmapause. The evidence of the plasma bulge and the associated plasma fluctuations, is generally consistent with magnetospheric convection models proposed by Nishida and by Brice. Author

N70-12940# Geoscience, Inc., Cambridge, Mass.
DETAILED CHARACTERISTICS OF MICROPULSATIONS IN THE FREQUENCY RANGE 0.1 – 2.0 Hz Final Report, 7 May 1965 – 15 Jun. 1968
Arnold S. Orange Mar. 1969 103 p
(Contract AF 19(628)-5096)
(AD-693223; RU-69013; AFCRL-69-0225) Avail: CFSTI CSCL 8/14

Geoelectric micropulsations recorded at Ashland, Maine on magnetic tape were digitized and analyzed. Emphasis was placed on examination of the complex pulsation activity in the frequency range 0.1 - 2.0 HZ by means of digital frequency-time analysis (sonograms). Results are presented which allow qualitative and quantitative study of micropulsation fine structure during both continuous and impulsive type events. Author (TAB)

N70-12957# Technische Univ., Berlin (West Germany). Inst. fuer Kerntechnik.
ENERGY REQUIREMENTS AND ENERGY IN OCEANOGRAPHY
U. Bauer, J. Beushausen, W. Mialki, and W. Zeisset May 1969 50 p refs In GERMAN
(TUBIK-14) Avail: CFSTI

Energy requirements for underwater vehicles and installations are compiled from several sources and specified in two categories according to their power and the duration of time for which a power supply is needed. A graphic display enables several kinds of undertakings to be distinguished by the structure of their energy demand. An estimate of future energy demands has been made. Energy sources and energy conversion systems suitable for underwater technology are reviewed briefly and certain criteria are discussed to evaluate systems for different kinds of undertakings. Prospective range of application for different systems is discussed in terms of power and duration. Author (NSA)

N70-13000# Texas A and M Univ., College Station. Dept. of Oceanography.
T-S CHARACTERISTICS OF THE GULF OF MEXICO AT INTERMEDIATE DEPTHS
J. W. Caruthers Jun. 1969 68 p refs
(PB-186286; A/M-REF-69-7T) Avail: CFSTI CSCL 08J

A close analysis of the T-S characteristics of the Gulf of Mexico at intermediate depths was made. The analysis involved defining a standard water mass for the Gulf and studying the salinity anomaly over the Gulf. This scheme allowed plotting the T-S characteristics on a greatly expanded scale. Changes in S relation over the Gulf were quite pronounced on this scale and visual interpretations could readily be made. The scheme also allowed analytical representations for the salinity anomalies which were averaged over ranges in temperature and plotted in a number field overlayed on the Gulf. Author (USGRDR)

N70-13030# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 213
1 Oct. 1969 60 p refs Transl. into ENGLISH from various Russian Articles
(JPRS-48947) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1 – 16 refs (See N70-13031 03-30)
2. METEOROLOGY p 17 – 22 refs (See N70-13032 03-20)
3. OCEANOGRAPHY p 23 – 24 refs (See N70-13033 03-13)
4. TERRESTRIAL GEOPHYSICS p 25 – 27 refs (See N70-13034 03-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 28 – 50 refs (See N70-13035 03-13)

N70-13033# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 213 1 Oct. 1969 p 23 – 24 refs (See N70-13030 03-13)
Avail: CFSTI

Publication of a new popular science book on the resources of the world ocean is reported in which special attention is paid to operations conducted on the continental shelf, such as special types of drill rigs, new methods for drilling boreholes, and working from artificial islands. The scheduled activities for the twentieth voyage of the A.I. Voyeykov weather ship over a 100-day cruise are briefly treated. The main task of the expedition is high altitude sounding of the atmosphere in the tropical region of the Indian Ocean using meteorological rockets. A.C.R.

N70-13034# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 213 1 Oct. 1969 p 25 – 27 refs (See N70-13030 03-13)
Avail: CFSTI

New data on Kamchatka volcanos, revealing vertical inhomogeneities in the upper mantle, are reported which refute the suggestion that magma foci are in the form of flattened spheroids. Airborne magnetic and gamma spectrometric measurements in Hungary since 1965 are discussed, and it is revealed that the information transmission capacity of a magnetic channel was increased by attaching it to a proton precession magnetometer. It is concluded that such complex aerial surveying, despite costly instruments and aircraft utilization, is extremely productive and economical in prospecting for mineral resources. An abstract is included of a scientific article dealing with first-mode Rayleigh waves as related to earth mantle studies. A.C.R.

N70-13035# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 213 1 Oct. 1969 p 28 – 50 refs (See N70-13030 03-13)
Avail: CFSTI

A detailed description of the design of the RG-1 radiometer, used for studying cosmic rays at altitudes of 200 - 400 km, is provided. The instrument measures distribution of absorbed doses by means of a tissue-equivalent ionization chamber, proton energy spectrum analysis from 0.5 to 10 MeV, and electron energy spectrum analysis from 60 to 500 KeV. The contents of a journal article dealing with space docking of Soyuz 4 and 5 spacecraft and possible future space stations are reviewed, as well as a presentation justifying continuation of the Soviet space program. Installation and operation of the Orbita television receiving station, used for reception from central television facilities via the Molniya 1 communication satellite, are reported. Finally, mention is made of the launching and scientific objectives of the Cosmos 295 and Cosmos 296 satellites, and abstracts of selected articles on upper atmospheric and space research are given. A.C.R.

N70-13057# California Univ., Livermore. Lawrence Radiation Lab.
A TECHNIQUE OF ELASTIC WAVE VELOCITY DETERMINATION IN A SECTION BY MEANS OF ACOUSTIC LOGGING [METODIKE OPREDELENIYA SKOROSTEI UPRUGIKH VOLN V RAZREZE S POMOSHCHYU AKUSTICHESKOGO KAROTAZHA]
G. I. Petkevich Aug. 1969 12 p refs Transl. into ENGLISH from Geofizicheskii Sb., (Russia), v. 23, 1968 p 97 104
(PB-186212T; UCRL-Trans-10368) Avail: CFSTI

A more dependable determination of seismic parameters is one method of increasing the effectiveness of seismic prospecting. Ultrasonic logging of velocity, or in a broad sense acoustical logging, was intended for obtaining highly accurate data on the velocities of elastic waves. However, such characteristics of acoustic logging as a high resolving power, the graphic form of the received data, and at the same time the limited radius of investigation have made it most effective for the study of borehole cross sections. This paper describes the sequence of stages of processing data from ultrasonic measurements on small base lines in boreholes for the purpose of determining velocities. This process combines the procedures used in seismic prospecting and industrial geophysics.
Author (USGRDR)

N70-13082# Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
A SELECTED ANNOTATED BIBLIOGRAPHY ON THE ANALYSIS OF WATER RESOURCE SYSTEMS
Marshall Gysi and Daniel P. Loucks Aug. 1969 197 p refs
(Grant DI-14-01-0001-1613)
(PB-186335; PUB-25-W70-00306) Avail: CFSTI CSCL 13B

Presented is an annotated bibliography of some selected publications pertaining to the application of systems analysis techniques to water resource problems. The majority of the references included in this bibliography have been published within the last five years. About half of the entries have informative abstracts and keywords following the citation. Index charts give quick keyword access for all the references, the abstracted documents being completely keyworded, and the others title keyworded. The emphasis of the subject material abstracted is on optimization and simulation techniques that have been applied to water resources problems.
Author (USGRDR)

N70-13098# Wyoming Univ., Laramie. Resources Research Inst.
INFORMATION INDEX OF GEOMAGNETIC OBSERVATIONAL DATA
Javin M. Taylor and John C. Bellamy Mar. 1969 22 p
(Grant E-291-68(G))
(PB-184790; IC-58) Avail: CFSTI CSCL 08N

The purpose of the report is to present the results of an experimental investigation into the potentialities of informatic forms of data for a particular geomagnetic-kind of Environmental Data Index.
Author (USGRDR)

N70-13104# Geological Survey, Denver, Colo.
ISOTOPIC COMPOSITION OF LEADS OF ANCIENT ROCKS [IZOTOPNYI SOSTAV SVINTSA DREVNEISHILCH POROD]
E. V. Sobotovich et al 1968 8 p refs Transl. into ENGLISH from Radiokhimiya (Moscow), v. 5, no. 2, 1963 p 157–160
(PB-184924T) Avail: CFSTI CSCL 08G

The study of the isotopic composition of lead (s) enclosed in various rocks is of considerable interest as regards the problems of geochronology. The dating of rocks and minerals by the ratio of lead isotopes opens new opportunities for application of the lead method. The isotopic composition (constitution) of lead (s) in rocks is described by the amount of primary (initial) lead enclosed in a rock at the time of its formation, and by the accumulation of radiogenic lead during the lifetime of the rock from the present uranium and thorium. Lead is separated and its isotopic composition determined from a series of specimens of most ancient acidic rocks of the Ukraine and from three specimens of ultrabasic rocks of the Monchegor pluton of the Kola penisula.
Author (USGRDR)

N70-13105# Geological Survey, Denver, Colo.
THE POINT METHOD OF INTERPRETING VES CURVES [TOCHECHNY METOD INTERPRETATSII KRIVIEKH VEZ]
V. D. Kukuruza 1968 13 p Transl. into ENGLISH from Razved. Promysl. Geofiz. (Moscow), v. 36, 1960 p 31–39
(PB-184910T) Avail: CFSTI CSCL 08N

The point method of interpreting VES curves consists of finding points on the interpreted curves, corresponding to values of apparent resistivity, the abscissa of which is equal to the depth of the bedrock layer. The interpretation procedure of the point method is very simple, because for every type of VES curve there is only two combination charts for the determination of the parameters of the section of the interpreted sounding curve. The proposed method can be used in different regions, as a supplementary quantitative method for the interpretation of VES curves.
Author (USGRDR)

N70-13170# Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
PREDICTING DIURNAL AND SEASONAL TEMPERATURES AT VARYING DEPTHS WITHIN SOIL PROFILES Progress Report, 1 Jul. 1968–30 Jun. 1969
James E. Newman 30 Jun. 1969 8 p refs
(Grant ESSA-E275-68(G))
(PB-184792) Avail: CFSTI CSCL 08M

During fiscal year 1968–69 all soil temperature observation stations previously planned were completed. Several computer programs were developed and several summaries have been made. Data collected under this study were used to determine the daily and seasonal climatology of soil temperatures in Indiana.
Author (USGRDR)

N70-13191# Environmental Data Service, Silver Spring, Md.
GUIDE TO SOVIET LITERATURE ACCESSIONS IN THE ATMOSPHERIC SCIENCES LIBRARY, AND THE GEOPHYSICAL SCIENCES LIBRARY Technical Report, May–Jun. 1969
Irene A. Donehoo and Henry Hacia 1969 67 p refs Transl. into ENGLISH from Russian publs.
(PB-185232T; ESSA-TR-WB-TA-22) Avail: CFSTI CSCL 04B

The Guide makes initial access to content of Russian literature possible by presenting translated tables of contents and annotations, and on a selective basis, authors' abstracts, introductions, summaries, and conclusions. Publications are listed by three categories, as follows: (1) Regular periodicals; (2) Irregular journals and serials; (3) Books and monographs.
Author (USGRDR)

N70-13236# Allied Research Associates, Inc., Concord, Mass.
SATELLITE SURVEILLANCE OF MOUNTAIN SNOW IN THE WESTERN UNITED STATES Final Report
James C. Barnes and Clinton J. Bowley Jun. 1969 87 p refs
(Grant E-196-68)
(PB-185149; ARA-8G57-F) Avail: CFSTI CSCL 08L

The application of satellite snow-mapping techniques to mountainous-terrain regions is investigated. The principal data sample consists of ESSA-3 AVCS photography of the western United States acquired during the 1967 winter and spring seasons; a smaller number of APT photographs from 1967 and 1968 is also analyzed. In addition, a sample of high-resolution color photography from the Gemini manned space flights is examined to evaluate the application of these data for snow surveillance. The results of these investigations indicate that in the western United States, mountain snow can be reliably identified in satellite photography. Identification can often be made from a single observation because of the characteristic shapes of mountain-snow patterns.
Author (USGRDR)

N70-13237# Geological Survey, Denver, Colo.
ISOTOPIC COMPOSITION OF RECENT LEADS AS AGE CRITERION FOR ISOLATED IGNEOUS ROCK SAMPLES [IZOTOPNYI SOSTAV SOVREMENNOGO SVINTSA KAK KRITERII VOZRASTA EDINICHNYKH OBRAZTSOV IZVERZHENNYKH POROD]

E. V. Sobotovich et al 1968 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geol. (Leningrad), v. 30, no. 4, 1965 p 3-9
(PB-184925T) Avail: CFSTI CSCL 08J

The lead isotopic isochrons of igneous rocks may supply information on the degree of heterogeneity of the subcrust or mantle. If regions with the identical Pb/U ratio are found in the parent substratum, using similar data, it will be possible to evolve a method of age determination of isolated rock samples from these regions by their lead isotope content. Author (USGRDR)

N70-13239# Research Triangle Inst., Durham, N.C.
PHYSICAL OCEANOGRAPHY FEASIBILITY STUDY UTILIZING NIMBUS 2 HRIR SATELLITE DATA Final Report
Fred M. Vukovich and Jackson O. Blanton Jul. 1969 144 p refs Prepared jointly with Duke Univ.
(Contract ESSA-E256-68(N))
(PB-184943) Avail: CFSTI CSCL 08J

The NIMBUS 2 HRIR sea-surface temperature data were compared with sea-surface temperature data obtained by the Duke University Marine Laboratory's research vessel (R/V) EASTWARD, and historical data. Three case studies of the Gulf Stream off the North Carolina coast and one case study of the effect of hurricane 'Faith' on the sea-surface temperature distributions were made. Author (USGRDR)

N70-13254# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
STRATIFYING STAND VOLUME ON NON-STEREO AERIAL PHOTOS REDUCES ERRORS IN FOREST SURVEY ESTIMATES
Robert C. Aldrich and Nancy X. Norick 1969 17 p refs
(PB-185810; FSRP-PSW-51) Avail: CFSTI CSCL 02F

Stratifying cubic volume in forest stands on non-stereo and stereo photography in double-sampling designs was compared by computer simulation techniques, in a study in North Carolina. Nonstereo photo techniques reduced variance for estimates of mean volume per acre and, in addition, increased sampling efficiency over ground sampling alone. But the differences in efficiency are not enough to justify changing present Forest Survey procedures for the southeastern United States. Author (USGRDR)

N70-13265# Wolf Research and Development Corp., Riverdale, Md. Special Studies Dept.
ANALYSIS OF SERIALS RELATED TO WATER RESOURCES
Walter F. Johanningsmeier, Robert E. Frye, and Robert F. Nasal Mar. 1969 148 p refs
(Contract DI-14-01-0001-1610)
(PB-185706) Avail: CFSTI CSCL 05B

A total of 1634 serial titles with probable relevance to the field of water resources were identified. Specimen issues of approximately 900 serials were located in Washington, D.C. area libraries. Of these, 867 serials were found to satisfy the subject and serial criteria developed for the study and were analyzed in depth. Selected information on each serial was recorded individually on a data sheet developed specifically for this project in conjunction with the staff of the Water Resources Scientific Information Center. In addition, a data file system providing for storage, maintenance, and retrieval of data on each serial was designed and put into service. Some of the current characteristics of water resources serials are discussed with particular emphasis on primary scientific or technical serials. Recommendations, based upon the findings of the study, are made for the inclusion of additional serials in the data file system. Author (USGRDR)

N70-13285# Hawaii Inst. of Geophysics, Honolulu.
PREDICTION OF TSUNAMI INUNDATION FROM CURRENT REAL-TIME SEISMIC DATA
William Mansfield Adams May 1969 66 p refs Supported by the State of Hawaii, NSF, and AEC
(PB-186417; HIG-69-9) Avail: CFSTI CSCL 08C

Contents: The physics of tsunamis: (theory of the generation of tsunamis, theory of the propagation of tsunamis, amplification by an island); development of a prediction algorithm; (the historical data for the Hawaiian Islands, local effect factor, the island factor, the attenuation factor, the canonical tsunami index, relationship of tsunami index to tsunami magnitude); the prediction algorithm. USGRDR

N70-13296# Army Electronics Command, Fort Monmouth, N.J.
COMPARISON OF COLUMNAR IONOSPHERIC ELECTRON CONTENT OBTAINED FROM SIMULTANEOUS MEASUREMENTS OF FARADAY ROTATION AND DOPPLER SHIFT
P. R. Arendt Sep. 1969 34 p refs
(AD-694365; ECOM-3170) Avail: CFSTI CSCL 4/1

A comparison of columnar content values calculated from Doppler slope and polarization data is given. Measurements were obtained simultaneously from radio beacon signals transmitted by the S-66 BEC satellite at 40, 41, and 360 MHz. The error of the Doppler method is 5%; the error of the polarization method is 3%. The ratio of the columnar content values varies between 0.75 and 1.22; larger deviations are related to horizontal gradients which affect mainly the precision of the Doppler data evaluation. Author (TAB)

N70-13378# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
ANALYSIS OF UNCERTAINTY IN GROUND MOTION AND STRUCTURAL RESPONSE DUE TO EARTHQUAKES
Erik H. Vanmarcke and C. Allin Cornell Apr. 1969 67 p refs Sponsored in part by the Ford Found.
(Grant NSF GK-4151)
(PB-186250; RR-69-24) Avail: CFSTI CSCL 08K

Sources of uncertainty are studied. A major factor is the significant scatter of the observed data about the proposed attenuation laws. Thus, the actual peak acceleration may be substantially different from the predicted value. The uncertainty is related to systematic differences at the sites where the motions were observed, such as local soil conditions which were not accounted for in the law. Other influences upon the dispersion in the data about the attenuation law are considered from earthquake to earthquake, noting variations in the mechanism generating the earthquake and variations in the propagation paths of the waves. Seismic risk analysis has been extended to account for peak structural response. Author (USGRDR)

N70-13412# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 215
30 Oct. 1969 74 p refs Transl. into ENGLISH from various Russian articles
(JPRS-49170) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1-6 refs (See N70-13413 03-30)
2. METEOROLOGY p 7-17 refs (See N70-13414 03-20)
3. OCEANOGRAPHY p 18-26 refs (See N70-13415 03-13)
4. TERRESTRIAL GEOPHYSICS p 27-41 refs (See N70-13416 03-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 42-53 (See N70-13417 03-13)

N70-13415# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 215 30 Oct. 1969 p 18–26 refs (See N70-13412 03-13)
Avail: CFSTI

Several sealab expeditions and research ship cruises are described briefly. Sea floor explorations and relief data are summarized and mineral resources are reviewed. Mesoplankton distribution and temperature fluctuations in the surface layers were investigated, and the properties of acoustic signal reflection by the surface are outlined. The equatorial countercurrent in the Atlantic was studied and nomograms were constructed to describe the mixing of four water masses. N.E.N.

N70-13416# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 215 30 Oct. 1969 p 27–41 refs (See N70-13412 03-13)
Avail: CFSTI

Gravimetric measurements and studies of the structure of the earth are reviewed. Pendulums and auxiliary equipment for making gravimetric measurements, and data taken on sea and land are described. Studies of the earth's structure emphasized the Siberian and West Siberian platforms and the northwest Black Sea and adjoining land. A suggestion is presented that continents shift before large earthquakes. The conductivity of rocks in the permafrost zone was mapped by electrical prospecting, and seismic prospecting was used to locate gas and petroleum as well as to study mantle structure. N.E.N.

N70-13417# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 215 30 Oct. 1969 p 42–53 refs (See N70-13412 03-13)
Avail: CFSTI

News articles and abstracts of scientific reports are presented. The MOL program is briefly described, and the increasing partnership between NASA and the Pentagon is stressed. Orbital assembly of spaceships, rocket engine thrust, satellite deceleration, and reentry vehicle braking are discussed. The operation of the Orbita–Molniya TV station, and the launchings of Cosmos 300, Cosmos 301, Meteor satellite, Apollo 8 and Apollo 11 are announced. A review of the present knowledge of ionospheric aerodynamics is mentioned, along with polar cap absorption in May 1967 and the albedo of interstellar dust particles. N.E.N.

N70-13448# Environmental Research Corp., Alexandria, Va.
AMPLIFICATION OF RAYLEIGH WAVES IN A SURFACE LAYER OF VARIABLE THICKNESS
J. R. Murphy and A. H. Davis 4 Feb. 1969 54 p refs
(Contract AT(29-2)-1163)
(NVO-1163-175) Avail: CFSTI

A method of calculating the relative amplitudes of Rayleigh waves as a function of frequency at two observation points located on surface layers with differing thickness or physical properties is presented. The analytic approach centers on a solution of the boundary value problem which allows the amplitude as a function of depth to be written in terms of a single unknown; the free surface amplitude. The energy flux is assumed to be equal at the two horizontal positions of interest, and the ratio of the free surface amplitudes at the two locations can be computed as a function of frequency. A computer program which has been written to compute these amplitude ratios is described and a series of theoretical amplification curves are presented for models considered to be representative of the geology in and around the Nevada Test Site. Recommendations are made that the analytic model presented in this report be tested empirically using data from the Las Vegas valley instrumentation line. Author (NSA)

N70-13456# Akademiya Nauk URSR, Kiev.
SOME PROBLEMS OF INTERPRETING DATA OF THE METHOD OF TRANSIENT PROCESSES BY CALCULATING THE FINITE DIMENSIONS OF THE GENERATOR CIRCUIT
F. M. Kamenetskiy, P. P. Makagonov, and V. M. Timofeyev *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 42–44 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

The problem of the transient field of an ungrounded circuit of finite dimensions is considered in the presence of a thin, infinite sloping stratum. Based on the solution of this problem, a method is given for calculating the longitudinal conductivity and depth of deposition of the stratum. Transl. by R.B.

N70-13462# Akademiya Nauk URSR, Kiev.
THE LOGARITHMIC FORM OF PRESENTING GEOPHYSICAL INFORMATION
V. K. Rybin and A. P. Savin *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 103–117 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

A proposal is made to present the results of geophysical prospecting in logarithmic form and the advantages of using the logarithmic method are considered in detail. The errors of logarithmic and linear scales are compared. A new term, the 'decilog,' equal to ten times the logarithm of the ratio of the measured value to zero level, is proposed as a universal geophysical unit. Recommendations are given for selecting zero level and examples are cited for using the logarithmic system to represent geophysical data. Transl. by R.B.

N70-13468# Akademiya Nauk URSR, Kiev.
ON THE PROBLEM OF PROSPECTING BY DIVINING ROD
G. S. Frantov *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 159–164 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

A brief survey is presented of work in surveying subterranean water sources, rock interfaces, and ore deposits by using of divining rods. Examples are cited of recent effective work of dowsers. Transl. by R.B.

N70-13483# Sandia Corp., Albuquerque, N.Mex.
THE EFFECT OF SOIL PARAMETERS ON EARTH PENETRATION OF PROJECTILES Technical Report
L. J. Thompson, G. H. Ferguson, III, J. D. Murff, and Ayhan Cetiner Jul. 1969 166 p refs Prepared in cooperation with Texas A and M Research Found.

The purpose of this study can be divided into the three following parts: to present complete sets of data obtained for projectile penetration into soil targets of precisely known properties, and to describe how to build and test these targets; to present a numerical method of data analysis for empirically determining the force on a projectile, during penetration; and to demonstrate how physical soil parameters, as well as impact velocity and a projectile property influence penetration. Author (USGRDR)

N70-13484# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 214

14 Oct. 1969 58 p refs Transl. into ENGLISH from various Russian articles
(JPRS-49053) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–5 refs (See N70-13485 03-30)
2. METEOROLOGY p 6–15 refs (See N70-13486 03-20)
3. OCEANOGRAPHY p 16–32 refs (See N70-13487 03-13)
4. TERRESTRIAL GEOPHYSICS p 33–36 refs (See N70-13488 03-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 37–42 (See N70-13489 13-13)
6. "CHERNOMOR" SEALAB DESCRIBED Supplement p 43–51

N70-13487# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 214 14 Oct. 1969 p 16–32 refs (See N70-13484 03-13)
Avail: CFSTI

Proceedings on the study of the Atlantic Ocean and the Baltic Sea and the use of their resources are reported. The book, "Vertical Distribution of Oceanic Zooplankton", describing viable distribution patterns to the maximum depths of the ocean, is reviewed. News items describe an instrument for registering aerodynamic pressure; the new Soviet weather ship 'Passat', the weather ships 'Aysberg' and 'Okeanograf' operating in the North Atlantic; protection of the natural resources of the continental shelf; French-Soviet cooperation in ocean research; and a small underwater research craft. Abstracted articles included: characteristics of accumulation and distribution of iron in the sediments of the Kandalaksha Gulf and adjacent parts of the White Sea; checking the Tsurikov formula for salinity of sea ice using observational data; experimental phase and orbital velocities of gravitational waves of finite height; the structure of the equatorial waters of the Indian Ocean; bottom relief effects on geostrophic flow in the Pacific Ocean; mechanical sedimentation characteristics in the coastal zone in the southeastern Baltic; vertical distribution, spawning, and number of mass pelagic polychaetes in the northwestern part of the Pacific Ocean; concentration analysis of strontium-90 in the Atlantic Ocean; salt exchange between the ocean and the atmosphere; hyperbasites and gabbros from rift zones of the Arabian Sea-Indian Ocean and Western Indian submarine ridges; suspended organic matter content in Arabian Sea waters; and horizontal distribution of phytoplanton in the Gulf of Mexico. M.H.E.

N70-13488# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 214 14 Oct. 1969 p 33–36 refs (See N70-13484 03-13)
Avail: CFSTI

Abstracts of articles describe the following topics: the seismic properties of the crystalline basement determined from measurements in a deep borehole; the propagation theory of electromagnetic waves in layered anisotropic media; methodology for study of deep structures of ore-bearing regions; and gravitational and magnetic field observations. M.H.E.

N70-13489# Joint Publications Research Service, Washington, D.C.

UPPER ATMOSPHERE AND SPACE RESEARCH

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 214 14 Oct. 1969 p 37–42 refs (See N70-13484 03-13)
Avail: CFSTI

News items report the working plans for orbita television programming via the Molniya satellite, and the launching parameters of Cosmos 297, 298, and 299. Abstracts of scientific articles include: the approximate determination of twilight glow brightness of the real earth's atmosphere in the region 0.4 to 1.06 m; reactive impulse during collision of spherical particles with barriers; and the plasmapause configuration in the presence of subsonic convective flow in the magnetosphere. M.H.E.

N70-13504# Texas Univ., Austin. Hydraulic Engineering Lab.

A NUMERICAL MODEL FOR THE SIMULATION OF TIDAL HYDRODYNAMICS IN SHALLOW IRREGULAR ESTUARIES

Frank D. Masch, N. J. Shankar, M. Jeffrey, R. J. Brandes, and W. A. White Feb. 1969 135 p refs
(Grant DI-14-01-0001-1591)
(PB-184834; HYD-12-6901) Avail: CFSTI CSCL 08C

Working under the assumption of complete vertical mixing, a two-dimensional time dependent model is described which provides spatial and temporal variations of tidal flows and amplitudes. The model accounts for various physiographic features found in shallow estuaries, variable inflows, low tidal action, and other hydrologic characteristics. The model further provides for the inclusion of wind stress and Coriolis forces. The basic outputs from the model are the time histories of tidal amplitude and velocity in each of the two spatial coordinate directions. Data that can be obtained from the model include phase relations, time of flood, ebb, and slack tides, net flows, circulation patterns, tidal excursions, and tidal prisms. Author (USGRDR)

N70-13509# Bureau of Mines, Washington, D.C.

ELASTIC MODULI OF ROCK AT ELEVATED TEMPERATURES

Carl F. Wingquist Jun. 1969 22 p refs
(PB-184818; RI-7269) Avail: CFSTI CSCL 08G

In support of Bureau of Mines studies of thermal fragmentation of rock, the elastic moduli of four types of rock were measured at temperatures ranging from room temperature up to 1,500F (1,089K). The sonic method was employed to determine the resonant frequencies of the rock specimens and from these frequencies, the elastic moduli were calculated. Data for Young's modulus, shear modulus, and Poisson's ratio are given as a function of temperature for Dresser basalt, Reserve taconite, Jasper quartzite, and Charcoal granite. Young's modulus and the shear modulus decreased with increasing temperature up to about 1,200F and then became relatively insensitive to temperatures from 1,200 to 1,500F. Author (USGRDR)

N70-13516# Iowa State Univ. of Science and Technology, Ames. Soil Research Lab.

SEISMIC WAVE VELOCITY AS A MEANS OF IN-PLACE DENSITY MEASUREMENT, PART 1 Final Report

J. M. Hoover and R. L. Hanov 1969 41 p refs Sponsored in part by Iowa State Highway Comm.
(PB-185088) Avail: CFSTI CSCL 13B

The objective of this investigation was to apply principles of first-arrival seismic refraction to the problem of determining in-place dry density in a soil embankment. The seismic refraction technique is a method by which velocity of a seismic wave is obtained by measuring the time for the wave to travel between known distances measured on the ground surface. The laboratory method of study involved correlation of results of seismic wave measurements with conventional dry density and moisture content measurements of several soils. Field seismic measurements were correlated to in-place moisture-density determinations. The ultimate goal was an economic improvement in construction control testing, since the time required to perform an in-place seismic measurement on an embankment in much less than that required for conventional moisture-density determination. Author (USGRDR)

N70-13518# California Univ., San Diego. Scripps Inst. of Oceanography.
MEASUREMENT OF THE ABSORPTION COEFFICIENT OF HYDROSOLS Interim Technical Report
John E. Tyler and Wayne H. Wilson Nov. 1968 19 p refs
(Contract NObsr-95251)
(AD-677932; SIO-Ref-68-32) Avail: CFSTI CSCL 8/10

A theoretical method is described for the measurement of the optical volume absorption coefficient of natural bodies of water using the divergence of the vector irradiance field. Laboratory equipment has been constructed for the evaluation of the feasibility of using the method. The laboratory equipment is described and preliminary data is shown. Author (TAB)

N70-13553# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ATMOSPHERIC TURBULENCE
V. I. Tatarskii 23 May 1969 14 p Transl. into ENGLISH from Zemlya i Vselennaya (USSR), v. 4, no. 2, 1968 p 43–46
(AD-693842; FTD-MT-24-45-69) Avail: CFSTI CSCL 4/1

In this conversational approach to the effects of atmospheric turbulence, the atmosphere is compared to a tube filled with water containing some visible particles which can be observed as they are affected by turbulent motion. The effects of turbulence are seen in the action of an airplane when pressure on the wings is uneven, causing a bumpy ride. Turbulence has a great effect in preventing heavy gases, smoke, radioactive waste, and such substances from collecting at the surface of the earth. It is also seen to have great influence on the heat cycle, refraction, propagation of radio waves, and astronomical observations, causing stars to appear to twinkle. Author (TAB)

N70-13560# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 212
16 Sep. 1969 52 p refs Transl. into ENGLISH from the Russian
(JPRS-48829) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–6 refs (See N70-13561 03-30)
2. METEOROLOGY p 7–8 refs (See N70-13562 03-20)
3. OCEANOGRAPHY p 9–10 refs (See N70-13563 03-13)
4. TERRESTRIAL GEOPHYSICS p 11–17 refs (See N70-13564 03-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 18–45 refs (See N70-13565 03-13)

N70-13563# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet -Bloc Res. in Geophys., Astronomy, and Space No. 212 16 Sep. 1969 p 9–10 refs (See N70-13560 03-13)
Avail: CFSTI

A new find of a large quantity of phosphorite nodules in the Gulf of Aden is reported, and the nodules are described. Manganese in the sediments deposited on the bottom of the Pacific Ocean were studied, and it is suggested that the manganese has its origin in magma. N.E.N.

N70-13564# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 212 16 Sep. 1969 p 11–17 refs (See N70-13560 03-13)
Avail: CFSTI

Articles on geomagnetism, seismic prospecting, and instrumentation are summarized. Geomagnetic anomaly and paleomagnetic data analyses were made. A sensitive quartz compass for use in regions with a small horizontal component, and electromagnetic interference effects on nuclear precession magnetometers are described. Marine and terrestrial seismic prospecting and data processing methods are mentioned. The mechanism of generation and development of pearls was studied, and data confirm that cyclotron instability is the primary mechanism responsible for their appearance. A monograph is reviewed which discussed the sources of heat in the interior of the earth and moon, the heat transfer processes in their interiors, and the thermal history of the bodies under the influence of radioactive decay. N.E.N.

N70-13565# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 212 16 Sep. 1969 p 18–45 refs (See N70-13560 03-13)
Avail: CFSTI

Space flights, spacecraft launchings, and studies of the atmosphere, geomagnetism, and auroras are briefly reported. The preparation, launching, flight around the moon, and return to earth of Zond 7 are described. Equatorial boundary of the auroral zone, ring current effects on auroral absorption zone, and the auroral absorption in 1966 were investigated. Data on geomagnetic storms 1957-1964 are summarized. The acceleration of cosmic rays by the solar wind and a model of comets are mentioned. Atmospheric photoionization and circulation, isonospheric sounding and propagation, and magnetospheric electrons and ions were also studied. A large body of ore in Bulgaria was found as a result of an investigation of a local anomaly in radio wave propagation. N.E.N.

N70-13645# Wisconsin Univ., Madison. Dept. of Soil Science.
ACTUAL EVAPOTRANSPIRATION AS DETERMINED FROM SOIL-WATER AND CANOPY CHARACTERISTICS AND POTENTIAL EVAPOTRANSPIRATION Progress Report, 1 Jun. 1968–31 May 1969
C. B. Tanner and W. R. Gardner May 1969 43 p refs
(Grant ESSA-E287-68(G))
(PB-184791) Avail: CFSTI CSCL 04B

Water loss from soils supporting vegetation is due to either evapotranspiration or drainage. These two components of the water balance of the crop are the most difficult to either measure or calculate. Both advancement in hydrology and increased water use efficiency requires a better understanding of the physics of evapotranspiration under drouthy conditions and drainage when the soil is wet. We have investigated means of calculating both of these components of the hydrologic balance from primary climate, soil, and plant parameters. Author (USGRDR)

N70-13646# Rutgers Univ., New Brunswick, N.J.
DETERMINATION OF DIELECTRIC CONSTANT AND ELECTRO-CONDUCTANCE OF SOME FROST-PRONE SOILS
Alfred R. Jumikis Sep. 1969 52 p refs
(Grant NSF GK-1294)
(PB-186397) Avail: CFSTI CSCL 08M

The report presents a summary of the results of experimental studies concerning the determination of dielectric constant and electrical conductance of some frost-prone soils. Because temperature, as a thermal factor, and porosity are important elements in the processes of thermo-osmosis and moisture migration in soil, the dielectric constant and electrical conductance values were determined. Author (USGRDR)

N70-13670# Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.
STRATIGRAPHY AND SEDIMENTATION OF LOWER BEACON ROCKS IN THE CENTRAL TRANSANTARCTIC MOUNTAINS, ANTARCTICA
John F. Lindsay Aug. 1969 64 p refs
(Contract AT(11-1)-1473; Grants NSF GA-534; NSF GA-1159)
(PB-186359) Avail: CFSTI CSCL 08G

The horizontally bedded lower Beacon rocks of the Queen Alexandra, Queen Elizabeth, and Holland Ranges rest unconformably on the highly deformed Precambrian to Lower Paleozoic basement complex. The sequence is divided into the Alexandra, Pagoda, and Mackellar Formations. The sediment was deposited in a high energy, shallow water, nonmarine environment. Current structures suggest that sediment was supplied from both sides of a narrow basin and transported to the southeast along the length of the basin. The origin of the Mackellar Formation is probably related to isostatic depression of the land surface and the final retreat of the ice sheet which allowed an inland extension of the sea. Author (USGRDR)

N70-13718# Saclant ASW Research Center, La Spezia (Italy).
THE EFFECT OF PERIODIC BOTTOM LAYERING ON ACOUSTIC REFLECTIVITY
Ole F. Hastrup 1 Jul. 1969 32 p refs
(Saclantcen-TR-149) Avail: CFSTI

An inspection of a large number of cores taken in the Atlantic and Mediterranean shows that deep sea sediments are frequently deposited by turbidity currents, thereby causing alternate layers of clay and sand that in many cases are vertically distributed in a periodic way. It is shown that such a periodicity in the layers causes bands with low reflection losses in the frequency domain where the thickness of a combined clay-sand layer equals half the acoustic wavelength. This effect has been demonstrated by experimental data obtained from bottom reflection measurements in the Tyrrhenian abyssal plain near Naples. The periodicity of a composite clay-sand layer has been computed by Fourier transforms of the sediment density curves. The frequency obtained in this way, corresponding to the half-wavelength criterion, agrees very well with the low-loss frequency band determined from the experimental reflection-loss frequency curves. Author (ESRO)

N70-13768# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
ON THE EXCHANGE OF PHOTOELECTRONS BETWEEN CONJUGATE IONOSPHERES
S. D. Shawhan, L. P. Block, and C.-G. Fälthammar Jul. 1969 13 p refs
(Rept-69-22) Avail: CFSTI

In this brief report the mechanism for exchange of photoelectrons between conjugate ionospheres is discussed. The flux of conjugate photoelectrons and the impact ionization caused by them are computed and shown to be significant compared with the local photoproduction and with the derivative of the total electron content. Some consequences of this additional ionization are pointed out. The role of the conjugate photoelectron ionization for processes such as the diurnal variation of total electron content are discussed in detail and compared with observations in another paper (Shawhan and Block, 1969). Author (ESRO)

N70-13771# Saclant ASW Research Center, La Spezia (Italy).
AIR-SEA INTERACTION: THE FLUXES IN THE ATMOSPHERIC BOUNDARY LAYER
Riccardo Pesaresi 15 Aug. 1969 69 p refs
(Saclantcen-TR-153) Avail: CFSTI

This report contains a description and a synthesis of the models of energy transfer in the atmospheric boundary layer above the sea surface. Formulae are developed for the evaluation of the fluxes of momentum, sensible heat and latent heat by the 'profile' and the 'bulk-aerodynamic' methods, using readily accessible and measurable parameters whenever possible. For the sake of completeness a new model of the transfer in a stable atmosphere is described and tested on the limited experimental material available on the subject. Finally the factors influencing the accuracy of the flux evaluation are analyzed individually. Author (ESRO)

N70-13774# Arizona Univ., Tucson. Lab. of Isotope Geochemistry.
CORRELATION AND CHRONOLOGY OF ORE DEPOSITS AND VOLCANIC ROCKS Annual Progress Report
Paul E. Damon Jul. 1969 141 p refs
(Contract AT(11-1)-689)
(COO-689-120) Avail: CFSTI

Refinements in experimental equipment and techniques for performing argon analyses on rock samples are described. Methods for flame photometric potassium analysis and rubidium and strontium determinations by mass spectrometry and X-ray fluorescence analysis were unchanged. Gamma spectrometry was used to measure radiation emitted from geologic and reactor irradiated samples. Studies continued to determine: the low-temperature loss of Ar-40 in potash feldspars; strontium diffusion in feldspar; Sr-87/Sr-86 ratios in Arizona volcanic rocks; geologic history of the Chiricahua Mts.; K-Ar dating information on ores from the Tintic District, Santa Catalina Mts., Tortolita Mts., the Arizona Basin and Range Province, and a sample of Older Tuff material from South Tanzania, Africa. Trace element and chemical-petrographic studies were continued with emphasis on the behavior of Mo, Ti, and W in the porphyry copper environment. The chemical compositions of numerous samples of volcanic rocks of various geographical origins are tabulated. NSA

N70-13819# United States Lake Survey, Detroit, Mich. Corps of Engineers.
COMPUTER PROGRAM FOR SEDIMENT TEXTURAL ANALYSIS Final Report
Sam B. Upchurch Jul. 1969 34 p refs
(AD-693791; MP-69-3) Avail: CFSTI CSCL 8/8

A comprehensive program for the textural analysis of grouped sediment data, including sieved and pipetted samples, is presented. This program, designed for small computers, converts the raw weights of size-graded sediment into weight percents, cumulative percents, and a frequency histogram. Computed statistics include: percents of gravel, sand, silt, and clay for lithofacies analysis; and mean, standard deviation, skewness, and kurtosis, computed by the methods of moments, Trask, Inman, and Folk and Ward. The program is advantageous because of the ease with which each sample may be evaluated, and the four common methods of computing textural parameters may be compared. Author (TAB)

N70-13889# Leeds, Hill and Jewett, Inc., San Francisco, Calif.
A PLAN FOR A COMPREHENSIVE WATER RESOURCES RESEARCH INFORMATION EXCHANGE SYSTEM Final Report
Harvey O. Banks and Charles G. Wolfe Aug. 1969 153 p refs
(Contract DI-14-01-0001-1618)
(PB-185801) Avail: CFSTI CSCL 05B

A study was made of the nature and effectiveness of the present procedures used by the Office of Water Resources Research of the United States Department of the Interior and the 51 State Water Resources Research Institutes to obtain information on problems requiring research and to disseminate the results of research projects. The report contains a recommended research information exchange system in which the information gathering and dissemination activities of OWRR and the State Institutes would be better defined and would be expanded, and use would be made of the capabilities of Federal information dissemination services, professional societies, and other communication media. Author (USGRDR)

N70-13890# Universities Council for Earthquake Engineering Research, Pasadena, Calif.
NSF-UCEER CONFERENCE ON EARTHQUAKE ENGINEERING RESEARCH
May 1969 299 p refs Held at Berkeley, Calif., 27–28 Mar. 1969 Prepared in cooperation with NSF
(PB-186181) Avail: CFSTI CSCL 13M

The purpose of the conferences was to enable university research workers in the field of earthquake engineering to exchange information on their current work and to help them plan and coordinate future research programs to provide society with an economic means of combating the earthquake hazard. Probability studies in seismicity are aimed at providing sufficient information to make rational decisions weighing economic and seismic risk; random vibration studies give information on the probability of structures surviving earthquakes; experimental studies provide information on the actual behavior of structural materials and components under earthquake loading. Author (USGRDR)

N70-13942# Istituto di Fisica dell'Atmosfera, Rome (Italy).
LIGURIAN SEA SURFACE TEMPERATURE MEASUREMENTS WITH INFRARED RADIOMETER (PRT-5) [MISURE DELLA TEMPERATURA SUPERFICIALE DEL MAR LIGURE MEDIANTE RADIOMETRO INFRAROSSO (PRT-5)]
M. Colacino Apr. 1969 23 p refs In ITALIAN Sponsored by Consiglio Nazl. delle Ric.
(IFA-SR-25) Avail: CFSTI

Results are presented of an airborne survey of the Ligurian sea water surface temperature using an infrared radiometer which was carried out as part of the international survey of the western Mediterranean sea. Equipment used is described and methods of measurement are discussed. ESRO

N70-13967# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
ACCURACY OF COMPUTATION OF THE ANOMALOUS PART OF THE GRAVITATIONAL FIELD OUTSIDE THE EARTH [TOCHNOST' VYCHISLENIYA ANOMAL'NOY CHASTI GRAVITATSIONNOGO POLYA VNE ZEMLI]
M. S. Molodenskii Sep. 1969 11 p Transl. into ENGLISH from Tr. Tsniigaik. (Moscow), no. 176, 1969 p 3–8
(AD-693863; ACIC-TC-1578) Avail: CFSTI CSCL 8/5

Formulas are obtained for the accidental error of the radial gravity component outside the earth as a function of the accidental error of the pure gravity anomaly over equal area elements. Author (TAB)

N70-13975# Geological Survey, Denver, Colo.
ULTRASONIC MULTI-CHANNEL LOGGING WITH CLAMPED SONDES IN ENGINEERING GEOLOGICAL INVESTIGATIONS
V. I. Koptev 1968 26 p refs Transl. into ENGLISH from Geoacoustics (Moscow) 1966 p 84–94
(PB-184927T) Avail: CFSTI CSCL 08G

A portable installation was constructed for the detailed ultrasonic logging of engineering geological boreholes to a depth of 100–200 m and a minimum diameter of 59 mm. The installation consists of a seven-element sonde with a hinge-type clamped device; it permits measurements of velocity and attenuation of elastic waves using the reverse profile of observations. The field accuracy of the velocity determination is plus or minus 1 to 2 percent for isolated layers of a minimum thickness of 0.2-0.5 m. Multichannel logging with a clamped sonde is suitable for detailed studies of borehole sections in engineering geology and mining, as well as in parametric measurements in seismic prospecting and seismology. Author (USGRDR)

N70-13992# Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
ABSOLUTE DATING OF OCEAN SEDIMENTS BY USE OF Th-230/Pa-231 RATIO AND GEOCHEMICAL STUDIES OF LIMITING BOUNDARY CONDITIONS WITH SPECIAL ATTENTION TO EXOTIC ENVIRONMENTS Annual Progress Report
Elizabeth Rona Aug. 1969 14 p refs
(Contract AT(40-1)-3622)
(ORO-3622-5) Avail: CFSTI

The results of continued oceanographic research which involves the absolute dating by radioactive methods of several deep ocean cores from the Caribbean and the radiochemical analyses of cores from anoxic basins, specifically from Powell Lake, B. C. and from the Cariaco Trench, are presented. Both C-14 and Th-230/Pa-231 dating methods were used—the former for ages up to 40,000 years, and the latter for ages up to 150,000 years. Using these methods, it was found that the most consistent results were from deep-sea cores taken from the Caribbean Sea. NSA

N70-13996# Geological Survey, Denver, Colo.
ELECTRICAL SOUNDING BY THE FIELD DIFFERENCE METHOD [ELECTRICHESKIE ZONDIROVANIYA METODOM VICHITANIYA POLEI]
B. I. Rabinovich and N. G. Kezhutin 1968 25 p refs Transl. into ENGLISH from Geol. I Geofiz. USSR no. 5, 1962 p 107–119
(PB-184900T) Avail: CFSTI CSCL 08G

The differential method of sounding with a direct current is examined. On the basis of error analysis, it is concluded that the resolving power and the geologic effectiveness (of this method) is greater than that of the vertical electrical sounding method. Author (USGRDR)

N70-14015# Joint Publications Research Service, Washington, D.C.
SEISMIC AND HYDROACOUSTIC DATA ON T-WAVES (REVIEW)
S. L. Solovyev et al 19 Nov. 1969 38 p refs Transl. into ENGLISH from the book "Problema Tsunami—Voprosy Obrazovaniya i Rasprostraneniya Morskikh Razrushitelnykh Voln ot Zemetryaseniy i Ikh Operativnyy Prognoz" Moscow, Nauka, 1967 p 141–173
(JPRS-49277) Avail: CFSTI

Formation and propagation characteristics of T waves and the state of the art in recording them are discussed. Seismic and hydroacoustic wave transformations during the T wave propagation into the ocean are examined. The feasibility of recording T waves from Kuril Island sites is assessed. Recording data on occurrences of earthquake and nuclear explosion generated T waves are tabulated. J.M.C.

N70-14026# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 216
14 Nov. 1969 149 p refs Transl. into ENGLISH from various Russian articles
(JPRS-49253) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–3 refs (See N70-14027 03-30)
2. METEOROLOGY p 4–53 refs (See N70-14028 03-20)
3. OCEANOGRAPHY p 54–69 refs (See N70-14029 03-13)

4. TERRESTRIAL GEOPHYSICS p 70–86 refs (See N70-14030 03-13)

5. UPPER ATMOSPHERE AND SPACE RESEARCH p 87–135 refs (See N70-14031 03-13)

N70-14029# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 216 14 Nov. 1969 p 54–69 refs (See N70-14026 03-13)

Avail: CFSTI

News briefs and abstracts of scientific articles are presented. The general areas covered include the following: polar tide and surface levels; water currents in the Atlantic Ocean, Bering Sea, and Gulf Stream; land–sea and sea surface–atmosphere interactions; sea wave element determination; bottom relief and depth measurements; marine deposits and geology; Fresnel sound diffraction at sea surface and floor; thermonanemometers; and geochemistry. N.E.N.

N70-14030# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 216 14 Nov. 1969 p 70–86 refs (See N70-14026 03-13)

Avail: CFSTI

Descriptions of news and journal articles are presented. The following areas of investigations are included: gravity, geomagnetic, and geopotential measurements and anomalies; geophysical prospecting; earthquakes and seismic soundings; upper mantale and crust studies and effect of magnetically disturbing bodies on crustal parameters; and long-period galvanometer development. N.E.N.

N70-14031# Joint Publications Research Service, Washington, D.C.

UPPER ATMOSPHERE AND SPACE RESEARCH

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 216 14 Nov. 1969 p 87–135 refs (See N70-14026 03-13)

Avail: CFSTI

News briefs and abstracted journal data are presented. Soyuz launching and coverage are reported. Atmosphere ionization, and radio scattering and absorption are described. Ionospheric composition and fluctuations in mid-latitudes are covered, and geomagnetic measurements and geomagnetic storms are discussed. N.E.N.

N70-14065# Atomic Energy Commission, New York. Health and Safety Lab.

CALCULATION OF STRATOSPHERIC AIR SAMPLE VOLUMES

Barbara Krajewski Jul. 1969 26 p refs

(HASL-211) Avail: CFSTI

A practical working procedure is presented for calculating stratospheric air volumes sampled with the air filtering system known as the U-1 changer. A simple basic equation, describing the calculation of the volumes, uses information from the flight data log and the ambient volumetric flowrate and interpolation tables. The basic equation requires that the ambient flowrate be corrected for temperature, converted to standard conditions and finally multiplied by the sampling time to obtain the standard volume of air sampled. The temperature correction factor and the ambient flowrate are chosen from the proper interpolation table and ambient volumetric flowrate table, respectively. Use of the tables depends upon knowledge of the flight altitude and evaluation of the indicated air speed. A sample calculation is presented together with the five calibrated ambient flowrate and two interpolation tables. Author (NSA)

N70-14070# Geological Survey, Denver, Colo.

RESULTS OF TEST OF PILOT MODELS AND SAMPLES OF ACOUSTIC LOG (AK) APPARATUS AND SOME PROSPECTS FOR ITS USE [RESULTATY ISPYTANIL MAKETOV I ABRAZTSOV APPARATURY AKUSTICHESKOGO KAROTAZHA I NEKOTORYE PERSPEKTIVY EE ISPOLLZOVANIYA]

A. L. Peralman, G. K. Zorin, and G. Ya. Rabinovich 1968 15 p refs Transl. into ENGLISH from Geoakustica (Moscow), 1966 p 77–84

(PB-184926T) Avail: CFSTI CSCL 08G

The tests have indicated that the developed pilot model of acoustic log apparatus enables one to partition the borehole section according to the changes in the elastic properties of the rocks. It was established that not only the interval velocities but also the dynamic properties of recorded signals change depending on the lithology of deposits, and that the variations in the dynamic properties in many cases are more characteristic than variations in the interval velocity. Thus, for example, in transition from massive to clayey limestones there was observed a sharp change in the character of the recordings with a negligible change in the interval velocity (5,000 to 5,300 meters/sec). Author (USGRDR)

N70-14072# California Univ., Los Angeles.

REMOTE SENSING OF THE ENVIRONMENT

Aug. 1968 1034 p refs Presented at a 2-week short course sponsored by Calif. Univ., Los Angeles, Eng. and Phys. Sci. Extension and TRW Systems, 5-16 Aug. 1968

(Rept-807.4) Avail: CFSTI

Lectures given during a short study course in remote sensing of environment are presented, with emphasis on fundamental concepts, techniques and equipment, and potential applications. Imaging techniques; specific types of sensors, including side-looking radar systems and multispectral scanners; ground truth requirements; environmental factors affecting system performance; and data processing methods are treated in detail. Fields of application discussed in the various lectures are meteorology, oceanography, earth resource management and discovery, geology, and geography. For specific topics, see N70-14072 thru 14014. A.C.R.

N70-14073# Nevada Univ., Reno. MacKay School of Mines.

OVERVIEW OF REMOTE SENSING

Joseph Lintz, Jr. *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 49 p (See N70-14072 03-13)

Avail: CFSTI

Remote sensing of environment is defined as the utilization of various systems to acquire information concerning physical-chemical phenomena at a distance. The scope of research and development in governmental, academic, and military activities is outlined, and it is emphasized that many of the military devices are necessarily placed under security classification, particularly infrared scanning and mapping equipment and side-looking radar systems. A description is provided of systems in current operation, most of which are multispectral in nature, since they appear to provide a high degree of spatial resolution. The need for automated systems for data interpretation is discussed, and such problems as pattern recognition and automatic retrieval and scanning are briefly identified. Another difficulty in present day technology involves ground truth, defined as those ground parameters that contribute to sensor calibration and data interpretation. Finally, the application of remote sensing techniques to various disciplines, as well as the contribution to more effective use of the earth's resources, is mentioned followed by remarks concerning the planning necessary for successful accomplishment of a multispectral mission. A.C.R.

N70-14074# TRW Systems, Redondo Beach, Calif.
EFFECT OF THE ATMOSPHERE ON ELECTROMAGNETIC SENSING OF THE EARTH'S RESOURCES FROM A REMOTE PLATFORM
Robert S. Fraser and G. A. Cato *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 110 p (See N70-14072 03-13)
Avail: CFSTI

The general characteristics of the atmosphere, associated phenomena such as clouds, precipitation, and haze, and sources of radiant energy that relate to sensing from a remote platform above the earth are presented. Computations of radiance and flux for many applications over the entire spectrum are treated based on solutions to the equation of radiative transfer. The electromagnetic spectrum is treated for the three spectral bands used for satellite sensing: (1) the visible and near-visible band from 0.29 through 0.75 micron wavelength, in which scattering processes are of prime importance; (2) the infrared band from 0.75 through 22 micron wavelength, where both scattering and absorption processes are significant; and (3) the microwave band from 0.1 cm through 30 m wavelength. A.C.R.

N70-14075# California Univ., Berkeley.
IMAGING DEVICES WITH EXAMPLES FROM FORESTRY
Robert N. Colwell *In its* Remote Sensing of the Environ. Aug. 1968 19 p refs (See N70-14072 03-13)
Avail: CFSTI

The process of remote sensing of the earth's surface through the use of cameras and related imaging devices operated from aircraft and spacecraft is discussed from the viewpoint of effective management of forest resources. The primary purpose of the presentation is description of the most important of the imaging devices used for this purpose, the photographic films used in conjunction with them, and some of the modern viewing and interpretation equipment. The five types of sensors with greatest potential for providing forest inventories are: (1) conventional aerial cameras; (2) the panoramic camera; (3) the multiband camera; (4) the optical mechanical scanner; and (5) side-looking airborne radar devices. Examples of the use of remote sensing in specific cases involving forestry problems are also given. A.C.R.

N70-14076# Michigan Univ., Ann Arbor. Willow Run Lab.
FUNDAMENTALS OF INFRARED SENSING AND IMAGE INTERPRETATION
Donald S. Lowe *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 19 p refs (See N70-14072 03-13)
Avail: CFSTI

An analysis of the techniques, equipment, and basic principles of thermal infrared imagery is presented. Discussion is limited to passive image-forming techniques as opposed to active type sensing. Problems of image distortion are identified as parallax distortions in stripmaps which occur normal to the flight line, as well as those arising from display methods and variations in aircraft motion; and suggestions are given for their correction. It is recommended that two spectral regions be used for optimum thermal mapping: 4.5 through 5.5 microns and 8 through 14 microns. The first wavelength has advantages for mapping small, hot targets, while the latter is preferred for general terrain mapping. A.C.R.

N70-14077# Michigan Univ., Ann Arbor. Willow Run Lab.
MULTISPECTRAL IMAGING SYSTEM
Donald S. Lowe *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 65 p refs (See N70-14072 03-13)
Avail: CFSTI

Interpretation of imagery requires constrast between the object being sought and its background. A technique is described for increasing the contrast of selected objects based on their spectral reflectance or emittance characteristics, and two applications are discussed. Means for implementing this technique with an optical-mechanical scanner, multielement dispersing spectrometer, and electronic signal processing equipment are discussed and demonstrated. Author

N70-14080*# Purdue Univ., Lafayette, Ind. Lab. for Agricultural Remote Sensing.
A MULTICHANNEL IMAGE DATA HANDLING SYSTEM FOR AGRICULTURAL REMOTE SENSING
David Landgrebe and Terry L. Phillips *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 13 p ref Presented at Soc. of Photo-Opt. Instrumentation Engr. Seminar on Computerized Imaging Tech., Washington, D.C., 26 27 Jun. 1967 Submitted for publication
(Grant NGR-15-005-028)
Avail: CFSTI CSCL 08E

Significant problems in the area of data and image handling which arise in connection with systems for surveying agricultural conditions from aerospace platforms are discussed, and the need for remote sensing techniques for timely and accurate agricultural reconnaissance is emphasized. Factors that affect the choice of particular techniques are treated, as well as the necessity for a multispectral approach in order to increase the quantity of data. As a result of this increase in quantity, however, improved data handling methods and an analysis system that is independent of active human participation, but allows constant communication with the data, are required. For this reason, hardware such as digital displays and specific software procedures to permit operation of such a system must be developed. A.C.R.

N70-14081# California Univ., Riverside. Dept. of Geography.
REMOTE SENSING OF THE ENVIRONMENT AND ITS RELATION TO GEOGRAPHIC RESEARCH
Leonard W. Bowden *In its* Remote Sensing of the Environ. Aug. 1968 122 p (See N70-14072 03-13)
Avail: CFSTI

Predictions and suggestions for the potential use of remote sensing techniques from orbiting spacecraft are outlined as presented at a 1965 conference on the use of satellites in geographic research. Areas of possible application include: (1) energy and water budget investigations; (2) geomorphological and glaciological studies; plant cover and soil mapping; (3) resource utilization; (4) land use surveys; (5) contributions to urban data systems; (6) transportation density analysis and studies of possible transportation linkages or networks; and (7) mapping , imagery, and data processing systems on a global basis. A.C.R.

N70-14082*# Geological Survey, Washington, D.C.
SOUTHERN CALIFORNIA REMOTE SENSING PROGRAM
In Calif. Univ. Remote Sensing of the Environ. Aug. 1968 27 p refs Prepared by Geol. Surv. and Autometric/Raytheon Co. for NASA, Geol. Surv., and Mex./Brazilian Intern. Participation Program (See N70-14072 03-13)
Avail: CFSTI CSCL 08E

A geographic project of the Earth Resources Program is described, in which remote sensing missions, field data-gathering activities, and data interpretation exercises were conducted at a southern California test site in 1968. The effort consisted of preliminary site inspection, briefings on use of various sensors, data interpretation, and participation in ground measurements during the flight of the NASA Convair 240 and other aircraft. The research was conducted to define the scientific and economic benefits of remote sensing as a means of examining the resources of a complex region, including a major metropolitan center and its arid hinterland. Five broad subject areas are included in such a study: (1) land use; (2) population settlement patterns; (3) urban environmental problems; (4) ecological landscape characteristics; and (5) physical environmental conditions. A.C.R.

N70-14084# California Univ., Riverside.
MULTI-SENSOR SIGNATURES OF URBAN MORPHOLOGY, FUNCTION, AND EVOLUTION
Leonard W. Bowden *In its* Remote Sensing of the Environ. Aug. 1968 48 p refs (See N70-14072 03-13)
(SR-2; TR-2) Avail: CFSTI

Remote sensing techniques for studying the characteristics of urban environment, including diversity of land use, concentration of various types of activity, and economic and social functions are discussed. It is emphasized that such methods enable acquisition of data that is otherwise difficult or impossible to gather for the use of urban planners and researchers, but that data packages which allow the user to interpret the information are definitely required if remote sensing programs are to be effective. While morphologic identification is still the greatest area of application, functional analyses of land use and human activities are also valuable contributions made by remote sensing technology. Examples are for studying urban evolution in particular geographical areas. The specific techniques that have proven useful in urban research are (1) black and white panchromatic photography; (2) conventional color photography; (3) color infrared photography; (4) multiband and multispectral photography; (5) thermal infrared sensing; and (6) side-looking airborne radar. A.C.R.

N70-14085# Oregon State Univ., Corvallis.
APPLICATIONS AND POTENTIAL OF REMOTE SENSING IN THE ANALYSIS OF RANGE RESOURCES
Charles E. Poulton *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 39 p refs (See N70-14072 03-13)
Avail: CFSTI

The contribution of remote sensing techniques to range resource studies in the U.S. is discussed. A practical example is given of a research project at the University of Oregon aimed primarily at ecological resource analysis as an aid in land use and management decision making. Work flow procedures in such programs is treated in detail, and problems involved are mentioned. It is concluded that despite difficulties associated with interpretation of vegetation resources from conventional aerial photography, this system of remote sensing is greatly underdeveloped in relation to its potential application in the area of land resource management. It is particularly useful to the resource analyst not only because of the low cost in relation to more sophisticated equipment now being developed, but also because it can be effectively used in a double-sampling approach with color, color infrared, and black and white infrared techniques. High qualith panchromatic photography is also essential in effective interpretation of multispectral line-scan imagery of native vegetation resources. A.C.R.

N70-14086# TRW Systems Group, Redondo Beach, Calif. Computing Technology Development.
EARTH RESOURCES DATA BASE SYSTEMS
S. L. Kameny *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 19 p ref (See N70-14072 03-13)
Avail: CFSTI

The complexities and problems involved in developing an earth resources information bank are emphasized, and the relationship of such a data base to the total earth resources collection programs is delineated. An indication of the solved and unsolved problems relating to successful implementation of a dynamic, computerized data base is also given. The major difficulty lies in the fact that large volumes of earth reconnaissance data will be collected, communicated, processed, and analyzed on a scale never before realized as a result of the Earth Resources Program. Correlation, storage, and availability of this data in a meaningful form for users requires speedy analysis of the information and maintenance of the data base with little or no backlog. The user must also be able to obtain data specific to his needs, in forms that he can readily utilize, within reasonable time limits, and at reasonable cost. A detailed discussion is presented of the design and performance goals, functions, and storage capacity of the system, and its present status is indicated. A.C.R.

N70-14087# Nevada Univ., Reno.
GROUND TRUTH FOR GEOLOGY
Peter E. Chapman *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 27 p refs (See N70-14072 03-13)
Avail: CFSTI

Ground truth is defined as the process of gathering surface and relevant subsurface data for the purpose of interpreting remote sensing data. The amount and type of ground truth information needed is primarily dependent on the experiments being performed, the sensing instrument used, and the variables existing on the ground. A brief description of parameters affecting the total signal by each sensor is given, with special emphasis placed on thermal systems, as well as the methods of data collection and testing procedures. A.C.R.

N70-14088# Lamar-Merifield, Santa Monica, Calif.
GEOLOGICAL INFORMATION FROM SPACE PHOTOGRAPHY
Paul M. Merifield *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 27 p refs (See N70-14072 03-13)
Avail: CFSTI

The usefulness of high altitude photography in geologic studies is discussed, and several photographs and television images taken from above the atmosphere are analyzed to furnish an idea of the type of information recorded by them. Some aspects of satellite photogrammetry that are applicable to image interpretation are treated subsequently. The most complete coverage of the surface is in the form of TV pictures, but such photographs are less useful from a geologic standpoint owing to their lower resolution. One of the primary geological contributions of hyperaltitude photography is in identifying petroleum and mineral resources in unexplored or inadequately explored regions which are characterized not only by lack of geologic information but also of map and photographic coverage. It is emphasized that about 50% of the earth's surface is inadequately or completely unphotographed from the air, with most concentration being in North America and Europe. Satellite-borne cameras would yield photos with scales of about 1:2,000,000 to 1:250,000 from a 200-mile altitude; such small scale photos and maps made from them would be useful during the planning and reconnaissance stage of mineral and petroleum exploration. A.C.R.

N70-14089# Kansas Univ., Lawrence. Center for Research in Engineering Science.
RADAR AS A REMOTE SENSOR
R. K. Moore *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 126 p refs (See N70-14072 03-13)
(TR-61-7) Avail: CFSTI

Radar techniques not applicable to passive sensors due to lack of control over illumination are described; the techniques can be used to measure such factors as range, azimuth, and radial velocity. Radar return is determined by the many parameters, especially wavelength, roughness, and dielectric properties. Fundamental techniques used in theoretical descriptions of the scattering process are described briefly. Experiments indicate that radar return is influenced near the vertical by relatively flat parts of the surface and near the horizontal by surface elements with smaller radii; numerous additional measurements are needed, however, to describe radar return from natural surfaces and to relate to theory. Imaging radar systems can be very useful even without complete knowledge of scattering coefficient theory. Measurements under conditions controlled by earth scientists are also needed in this field before full interpretation is possible. Author

N70-14090*# Kansas Univ., Lawrence. Remote Sensing Lab.
POTENTIAL RESEARCH AND EARTH RESOURCE STUDIES WITH ORBITING RADARS: RESULTS OF RECENT STUDIES
Richard K. Moore and David S. Simonett *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 22 p refs (See N70-14072 03-13)
(Contracts NSR-17-004-003; NAS9-7175; N62305-67-C-0044; Grant NSF GK-1153)
Avail: CFSTI

Radar systems studies for earth resource use show that: (1) there is a role in space for focussed, semi-focussed and unfocussed synthetic aperture imaging systems; (2) that polypolarized, multifrequency imaging systems appear promising for earth resource studies; (3) that orbiting altimeters have a potential to determine small scale features of the geoid; (4) that scatterometers have a promising application in sea-state studies and, when teamed with passive microwave radiometers, will aid in evaluating roughness contributions to apparent sea temperatures; and (5) that polar orbiting and earth-synchronous radars may be able to detect rainfall over the sea. Applications studies confirm previous indications that imaging radar is a valuable adjunct to aerial photography in the study of linear geologic features, in deriving hydrologic parameters, in achieving an acceptable level of crop-discrimination, in mapping of natural vegetation, in certain types of regional land classification, and in the mapping of sea ice. The problems confronting interpreters faced with a potential deluge of space data are outlined and various approaches are examined. Author

N70-14091*# Kansas Univ., Lawrence. Center for Research in Engineering Science.
MEASURING SEA STATE AND ESTIMATING SURFACE WINDS FROM A POLAR ORBITING SATELLITE
R. K. Moore and W. J. Pierson *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 31 p refs Prepared jointly by Kans. Univ., Lawrence and N.Y. Univ. (See N70-14072 03-13)
(Contract NSR-17-004-003; Grant NsG-298; Contract N62306-1589; Grant NSF GP-2259)
Avail: CFSTI CSCL 08J

A radar scatterometer operating near vertical incidence at a wavelength not too much smaller than the standard deviation of ocean wave heights can produce sea-state information. When this scatterometer is in a polar orbit spacecraft, it can produce this information on a global scale. Calibration by comparing surface-measured wave heights with orbital scatterometry is required, however, before such a system can be an operational tool. Observations that yield wave height as a function of position over the ocean for each satellite pass will be essentially synoptic for a given northern or southern hemisphere. A correct initial state of the waves for forecasts of the waves; and a corrected version of the wind field over the ocean surface. If a satellite passes over a recently intensified cyclone it will detect the increase in wave height caused by the increased winds and esentially provide a series of estimates of the speed of the wind along a section through the cyclone. When correlated with cloud patterns, and the available ship reports, surface wind direction can be inferred, and continuity can be used to extend the pattern to each side of the line formed by the points where the waves were measured. Author

N70-14092# Kansas Univ., Lawrence. Dept. of Geology.
THE POTENTIAL OF RADAR IN GEOLOGICAL EXPLORATION
Louis Field Dellwig, Harold C. Mac Donald, and J. Norman Kirk *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 17 p refs (See N70-14072 03-13)
Avail: CFSTI

At the present time side-looking airborne radars (SLAR) are most for regional studies of remote, previously unmapped areas. Imaging radar systems may ultimately be most valuable for conducting regional investigations, but areas requiring detailed investigation can benefit from SLAR's unique ability to present certain types of data. Regardless of the nature of the study, dual-polarization imagery has proven the most effective in geologic investigation. In regional studies radar should be the primary and, in some instances, may be the sole sensor in areas where photographic coverage is not possible and where ground investigations are difficult or impossible. In detailed studies, radar detects subtle changes of lithology which in some cases appear to be directly responsible for isolating anomalous areas. It is anticipated that the value of radar to the geologist will be greatly enhanced when improved multi-band and dual-polarization systems can be utilized to obtain geological data. The value of long-wavelength imagery will be realized only when it is produced simultaneously with X- or K-band imagery. Author

N70-14093*# Barringer Research, Ltd., Rexdale (Ontario).
DETECTING THE OCEAN'S FOOD (AND POLLUTANTS) FROM SPACE
A. R. Barringer *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 36 p refs Reprinted Supported by NASA (See N70-14072 03-13)
Copyright. Avail: CFSTI CSCL 08J

Remote sensing techniques for identifying substances by their spectral absorption or emission characteristics are discussed, based on the fact that most vapors and gases exhibit strong absorption bands either in the ultraviolet, visible, or infrared spectrum. Instrumentation using an optical mask corresponding to the iodine spectrum is described, with indications of its potential use in air pollution detection. Studies also suggest that virtually all polyatomic gases and vapors can be detected by optical correlation spectrometry, including oil slicks at the air/sea interface. Films of oil having a thickness of greater than 10 microns show marked infrared characteristics that are suitable for remotely sensing by day or night and are classifiable as being of fish or mineral origin. Studies of fish oil vapors in the ultraviolet show absorption bands too short for passive remote sensing; sensitive, active methods aboard ship or aircraft may, however, be developed. Finally, spaceborne platforms may provide synoptic coverage of large portions of the world ocean, possibly setting up a surveillance capability in which the fishing industry could obtain continuous real-time readout on fish distribution. A.C.R.

N70-14095# Barringer Research, Ltd., Rexdale (Ontario).
THE USE OF MULTI-PARAMETER REMOTE SENSORS AS AN IMPORTANT NEW TOOL FOR MINERAL AND WATER RESOURCE EVALUATION
A. R. Barringer *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 13 p refs (See N70-14072 03-13)
Avail: CFSTI

The requirement for greatly improved methods of exploration for natural resources is discussed in relation to the expanding demands for raw materials. A new approach is suggested involving the use of multiple remote sensors in aircraft on a regional or national scale in order to assist in the production of high quality geologic maps. Examples are given of the joint use of electromagnetic, magnetic and radiometric airborne survey equipment. The application to water resource problems is demonstrated, and the latest advances in airborne pulse electromagnetic equipment are described. Progress is reported on the development of fully instrumented airborne systems with digital readout and computerized data reduction. Author

N70-14096# Barringer Research, Ltd., Rexdale (Ontario).
RADIOPHASE: A NEW SYSTEM OF CONDUCTIVITY MAPPING
A. R. Barringer and J. D. Mc Neill *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 9 p refs (See N70-14072 03-13)
Avail: CFSTI

A new system is described which utilizes the signals from VLF radio stations to detect the presence of dipping conductive sheets in the ground and to estimate the surface impedance of a homogeneous or horizontally stratified earth. Such signals propagate as ground waves for thousands of kilometers from the transmitter and penetrate to distances of hundreds of meters below the earth's surface. The technique measures those components of the VLF horizontal magnetic and electric fields which are in phase quadrature with the vertical electric field. Both theoretical studies and modeling demonstrate that these quadrature components are greatly influenced by the impedance of the underlying terrain. An airborne version of the system was flown on surveys over known mineral occurrences. Preliminary results suggest correlation between the radio signals and the underlying geology. Other potential applications include airborne mapping of water conductivity to determine the extent of pollution and estuarine salinity as well as mapping of ground conductivity to locate faults, shear zones, the distribution of permafrost, aquifers, etc. Author

N70-14097# Barringer Research, Ltd., Rexdale (Ontario).
THE INDUCED PULSE TRANSIENT AIRBORNE ELECTROMAGNETIC PROSPECTING SYSTEM
A. R. Barringer *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 29 p refs (See N70-14072 03-13)
Avail: CFSTI

The induced-pulse technique was developed in an attempt to achieve maximum depth of exploration and discrimination against spurious responses from conductive overburden. The method depends upon the generation of very high powered electromagnetic pulses and the measurement of the response of underlying terrain to these pulses. It was found that the ground reaction exhibits a transient decay of eddy currents, and the analysis of this decay provides an excellent means of identifying conductive orebodies of both the massive and disseminated sulphide type. Deep penetration is obtained by virtue of the time isolation which exists between the transmitted primary field and the secondary field received from the ground. The method was perfected during the past ten years and is now in widespread use. Improvements are continuing and it is hoped to develop it additionally as a new tool for water resource evaluation and general geological mapping. Ancillary equipment such as airborne magnetic and gamma-ray spectrometric equipment was developed for use with the system in order to provide an integrated approach. Author

N70-14098# Texas A&M Univ., College Station.
THE USES OF REMOTE SENSING IN OCEANOGRAPHY
George L. Huebner *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 57 p (See N70-14072 03-13)
Avail: CFSTI

Several oceanographic parameters are examined in detail, and comments are made regarding the use of remote sensing techniques for analyzing specific phenomena. Shipboard and airborne installation of the infrared thermometer for studying oceanic thermal structure is emphasized, since this feature is fundamentally related to the basic mechanisms in all marine processes. Several applications of infrared imagery, including its use for determining fresh water discharge or river outflow, are mentioned, but detailed discussion is not feasible due to the classified nature of most of the technology. A short treatment of microwave-scanning radiometer systems for remote sensing of sea ice conditions is also included. Other types of sensing employed in oceanographic studies are color photography, false-color infrared film photography, and ATS-type scanline imagery. A.C.R.

N70-14099# Oregon State Univ., Corvallis. Dept. of Botany and Plant Pathology.
SPACE APPLICATIONS FOR EARTH RESOURCES INFORMATION
J. R. Shay *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 16 p refs (See N70-14072 03-13)
Avail: CFSTI

Results of a recent project sponsored by the National Academy of Science upon request from NASA are discussed, including a technological evaluation of spaceborne systems for earth resources data acquisition and analysis of potential economic benefits that might be derived. Three criteria were used in evaluating possible applications to various disciplines, based on the unique features of satellite platforms and vehicles in contrast with aircraft or earth surface positions: (1) the synoptic viewpoint; (2) need for repetitive coverage; and (3) extent of global coverage required. If one or more of these features are necessary, it was concluded that the satellite clearly has advantage over other vehicles. Potential applications studied were (1) meteorology; (2) oceanography; (3) agriculture, forest management, and hydrology; (4) environmental pollution; (5) urban development and redevelopment; (6) transportation; and (7) geology. Discussion of the proposed activities of a Center of Earth Resources Information, intended to implement results of research and development for a 10-12 year period, is also presented. These activities include development of hardware, sensor-signatures, application technology, and a global land-use satellite system for near-term launch. A.C.R.

N70-14100# Society of Exploration Geophysicists, Tulsa, Okla.
GEOPHYSICAL APPROACH TO REMOTE SENSING
William A. Fischer *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 37 p (See N70-14072 03-13)
Avail: CFSTI

A brief outline is presented of the definition and requirements for remote sensing of geophysical phenomena. The geometric, goniometric, time, sensor, transmission, and processing variables are identified. Suggestions for reducing the effects of such variables are enumerated. A.C.R.

N70-14101# Society of Exploration Geophysicists, Tulsa, Okla.
SENSORS FROM SPACE
William A. Fischer *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 8 p refs Presented at the 37th Ann. Intern. Meeting of the Soc. of Exploration Geophysicists, Oklahoma City Submitted for publication (See N70-14072 03-13)
Avail: CFSTI

The use of spaceborne systems for remote sensing of environment is discussed, with emphasis on possible methods for more quantitative data acquisition. It is suggested that remote sensing from spacecraft can produce more data when the congruency problem—that of image transfer from various types of scanners to perspective formats—is solved. Reduction of the number of variables in single observations should lead to uniformity and comparability of data. Further, the geophysical community can aid in this goal by defining specifications for comparable observations and interpretation that will contribute to routine use of remote sensors in the earth science field. A.C.R.

N70-14102# Geological Survey, Washington, D.C.
ORBITAL SURVEYS OF THE EARTH
William A. Fischer *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 7 p Submitted for publication (See N70-14072 03-13)
Avail: CFSTI

Possible uses of spaceborne remote sensing techniques in earth science studies are briefly treated. It is suggested that the great speed and altitudes involved in satellite flights enable reduction of the time between making resource observations and taking action to solve any observed problems. These same attributes of spacecraft allow an increase in the area covered by one observation and at the same time reduce the number of variables within that

survey and successive ones. The resulting uniform view of the large parts of the earth helps in recognizing anomalies and in discovering new resources. A.C.R.

N70-14103# Geological Survey, Washington, D.C.
SATELLITE DETECTION OF NATURAL RESOURCES
William A. Fischer *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 11 p refs (See N70-14072 03-13)
Avail: CFSTI

It is believed that data to be derived from remote sensing systems placed in orbit around the earth will assist in meeting man's rapidly increasing need for natural resources. Analyses of Gemini and Nimbus photographs demonstrate that some features, known to be associated with mineral deposits, are visible from orbital altitudes. Many mineral deposits have been located by means of conventional exploration, along faults, associated with anomalously bleached rocks, and near contacts of certain igneous and sedimentary rocks. Some deposits have been pinpointed by noting local changes in topographic form and others by thermal abnormalities in the crust. At least one "low level" geothermal anomaly has been imaged from aircraft and it may be that infrared observations from space will assist in our search for sources of geothermal power. It is concluded that observation from satellites has unique properties that recommend its use for the detection and study of these anomalous features or conditions. Author

N70-14104# Geological Survey, Washington, D.C.
A RATIONALE FOR A GENERAL PURPOSE EARTH RESOURCES OBSERVATION SATELLITE
W. A. Fischer and C. J. Robinove *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 7 p (See N70-14072 03-13)
Avail: CFSTI

The rationale governing basic data collection for regional, integrated resource surveys of land, near-shore, marine, and oceanic areas of the world is defined. Spectral time-dependent and resolution-dependent data elements that are required for such surveys are discussed, and operational requirements for the observations by earth orbital satellites are derived. The presentation is confined to those methods of data collection and types of sensors that are within the present state-of-the-art. A.C.R.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-12715# Army Behavioral Science Research Lab., Washington, D.C. Support Systems Research Div.
EFFECTS OF INFORMATION REQUIREMENTS, TIMING PROCEDURES, AND PHOTO SCALE ON INTERPRETER PERFORMANCE
Thomas E. Jeffrey Jul. 1969 26 p refs
(AD-693280; TRN-211) Avail: CFSTI

The document reports on experimentation conducted to determine how the screening of real-time imagery is affected under differing conditions of intelligence requirements, timing procedures, and photo scale. Students in an image interpretation course screened rolls of photographic transparencies to select frames containing priority targets, at the same time detecting and identifying the targets. Half the men worked with imagery on one scale, half with imagery at another. Half the interpreters were machine-paced through the tasks; half were self-paced under a total time limit for each task. Performance on both screening and target identification was evaluated for completeness and accuracy. Author (TAB)

N70-12742# Sandia Corp.: Livermore, Calif.
APPLICATION OF MANGANIN GRIDS
V. C. Barr and J. S. Meeks Sep. 1969 39 p Supersedes SCL-DR-69-107
(Contract AT(29-1)-789)
(PB-185861; SCL-DR-69-107; SCL-DR-68-41) Avail: CFSTI CSCL 14B

The manual describes two techniques for installing etched manganin grids. Author (USGRDR)

N70-12778# National Environmental Satellite Center, Washington, D.C.
VIDICON DATA LIMITATIONS
Arthur Schwalb and James Gross Jun. 1969 27 p refs
(PB-185966; NESCTM-17) Avail: CFSTI CSCL 17B

The launching of the first United States meteorological spacecraft (TIROS 1) in 1960 opened an age where development of techniques for remote sensing of meteorological phenomena from space has become increasingly prevalent. Through 1968 and into 1969, the primary meteorological spacecraft subsystem for routinely viewing the world's weather has been the vidicon camera, a descendent of the TIROS 1 camera system. The intent of this paper is to present a brief summary of observations of vidicon camera operation, as well as to describe the techniques used in camera calibration and evaluation both before and after spacecraft launch. Particular emphasis is placed on demonstrating to the researcher the limitations of the data, whether originated in the camera system or resulting from processing. Author (USGRDR)

N70-12808# California Univ., Livermore. Lawrence Radiation Lab.
METHOD FOR EVALUATION AND CERTIFICATION OF THE MOORE NO. 3 UNIVERSAL MEASURING MACHINE
Donald L. Lane Jun. 1969 57 p
(UCRL-50679) Avail: CFSTI

Thirty-seven evaluation and certification tests developed at Lawrence Radiation Laboratory for the Moore Model No. 3 Universal Measuring Machine are described. Photographs of each test setup are included. Also given are strip chart recordings demonstrating the unique capabilities of an extremely sensitive instrument that detected an error caused by brinelled thrust surfaces of the lead screw. Author (NSA)

N70-12810# Oak Ridge National Lab., Tenn.
A SUPERCONDUCTING (Ni-Ti) LIQUID HELIUM LEVEL DETECTOR
K. R. Efferson Jul. 1969 22 p refs Presented at Cryog. Eng. Conf., Los Angeles, 1969 Submitted for publication Sponsored by AEC
(ORNL-TM-2665; CONF-690623-1) Avail: CFSTI

A superconducting liquid helium level indicator has been constructed and tested which utilizes a small Nb Ti wire as the detector element. A heater creates and helps maintain a normal zone in that portion of the wire which is above the liquid helium level while that portion of the wire below the liquid level remains superconducting. Thus, the liquid helium level is determined by the position of the normal-superconducting boundary. The output voltage is very high (0.22 volts/cm at 50 mA) and varies linearly with a change in position of the liquid level. This device works in much the same way as previous detectors made with Ta or Pb Sn alloy; however, it has the added advantage that it can be used in high magnetic fields. Data and construction details are presented. Author (NSA)

N70-12833# California Univ., Livermore. Lawrence Radiation Lab.

A HIGHLY SENSITIVE PHOTORESPONSE TECHNIQUE FOR DETERMINING IMPURITY AND DEFECT ENERGIES AND CONCENTRATIONS IN GERMANIUM

G. A. Armantrout 17 Jul. 1969 21 p refs Submitted for publication Supported by AEC

(UCRL-71625; CONF-690808-3) Avail: CFSTI

Ge(Li) detectors, which are very high resolution gamma-ray spectrometers, are very sensitive to the presence of carrier traps in the compensated region of the detector. The infrared response characteristics of a diode structure are different from those of a photoconductor, since in the former the formation of a complete electron-hole pair is required before a significant output can be observed. This complete pair formation can be thermally assisted or can result from successive photoexcitation of the carriers through allowed energy levels for photon energies less than the bandgap energy. An analysis of the resulting spectrum provides information concerning the responsible trapping centers in a given Ge(Li) detector. The properties of traps caused by copper, nickel, iron, and lithium in the Ge(Li) detectors were studied using this technique. Author (NSA)

N70-12886# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

IN-REACTOR PRESSURE TUBE GAUGING EQUIPMENT

J. Widger, (Orenda Engines, Ltd.), J. Escott, M. Mc Manus, and D. Nelson Aug. 1969 28 p refs

(AECL-3426) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.00

Equipment was developed to measure the inside diameter, straightness and surface defects of pressure tubes in a reactor. Inspections are carried out during reactor shutdown by inserting the measuring devices into the pressure tube which has been emptied of fuel and drained of coolant water. The new system produces a punched paper tape output which is processed by computer thereby replacing the manual calculating and plotting of the earlier system. The inside diameter gauging results are accurate to + or - 0.0003 in. and the surface roughness measurements to + or - 0.001 in. Author

N70-12908# United Kingdom Atomic Energy Authority, Harwell (England).

THE SPINNER AND SOME OF ITS APPLICATIONS

A. Spadaucchia and B. Hahn Jul. 1968 20 p refs Transl. into ENGLISH from Helv. Phys. Acta (Basel), v. 40, no. 8, 1967 p 1063 - 1079

(PB-185820T; AERE-TRANS-1117) Avail: CFSTI CSCL 18D

A new kind of detector for rare nuclear processes, called the spinner, is described. The principle is to produce negative pressures in a liquid by centrifugal forces. The metastable state can be destroyed as in the normal bubble chamber by energy deposition by particles. The spinner has so far proven useful for the determination of spontaneous fission rates and for the detection of very low neutron fluxes. Author (USGRDR)

N70-12911# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).

PHOTO-INTERPRETATION IN FOREST TYPE MAPPING AND INVENTORY

P. N. Gupta Aug. 1969 26 p refs

Avail: CFSTI

The usefulness of aerial photographs for forestry purposes and the need for training of personnel in practising photo-interpretation in this field are emphasized. An attempt has been made to show forestry planners and workers the way in which aerial photographs can be utilised actually in practice, for delineating forest types and for forest inventories. Worked out examples are given. Author

N70-12924# Oak Ridge National Lab., Tenn.

INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES. REPORT OF RESEARCH GROUP ASSIGNED TO ALPHA ENERGY STANDARDS

A. Rytz 10 Jan. 1969 12 p Transl. into ENGLISH from French report

(ORNL-tr-2193) Avail: CFSTI

Design modifications to the absolute alpha-particle spectrometer of the International Bureau of Weights and Measures for standardization of alpha sources are briefly discussed. NSA

N70-12935*# Norton Research Corp., Cambridge, Mass.

RESEARCH AND DEVELOPMENT PROGRAM ON COLD CATHODE MAGNETRON ULTRAHIGH VACUUM GAGE

R. M. Oman Washington NASA Dec. 1969 92 p refs

(Contract NAS1-5347)

(NASA-CR-1480) Avail: CFSTI CSCL 14B

Theoretical models of the magnetron gage are developed by treating the electronic charge cloud as a rotating fluid. Calculations are given for the gage oscillation frequency and an expression for the relation between the pressure and ion current. Author

N70-12945# Joint Publications Research Service, Washington, D.C.

PATENT APPLIED FOR STEREOSCOPIC PERSPECTROGRAPH

N. A. Vasilyev 1 Dec. 1969 12 p Transl. into ENGLISH from Byul. Izobret. (Moscow), no. 8, 1960 p 107 - 115

(JPRS-49348) Avail: CFSTI

An instrument which can be used in processing aerial photographs of cameras with different focal lengths is described. Using the principle of mechanical intersection, the instrument drafts a map directly in front of the observer. The instrument is designed for processing near vertical aerial photographs with tilts up to 20 degrees, and with cameras of any focal length. F.O.S.

N70-12976# Wisconsin Univ., Madison.

THE SIMULTANEOUS MEASUREMENT OF X-RAY QUALITY AND QUANTITY USING TLD

Michael G. Ort and John R. Cameron [1969] 16 p

(COO-1105-151; CONF-680920-12) Avail: CFSTI

A method is described for simultaneous determination of both the quality and quantity of a monodirectional X-ray beam using a modified commercial dosimeter consisting of natural CaF2 phosphor bonded to a metal cylinder. Upon exposure of the dosimeter, the dose received by the side toward the X ray source (anterior side, A) is different than that of the other side (posterior side, B) due to attenuation and buildup in the metal cylinder. Since this effect would be expected to differ with the effective energy of the beam, a measure of quality of the beam can be obtained if the orientation of the dosimeter during exposure and readout is properly maintained. The thermoluminescent (TL) measurement must be made on a special reader which permits the measurement on the TL from sides A and P separately and simultaneously. Author (NSA)

N70-12983# Army Medical Research Lab., Fort Knox, Ky. Experimental Psychology Div.

A RADIOACTIVE SOURCE OF EXPONENTIALLY DISTRIBUTED INTEREVENT INTERVALS WITH ELECTRONICALLY CONTROLLED RATE AND ORIGIN PARAMETERS Progress Report

James N. Cronholm 13 Jun. 1969 10 p refs

(AD-692848; USAMRL-825) Avail: CFSTI CSCL 5/10

The equipment described utilizes the fact that time intervals between successive disintegrations in an appropriately chosen radioactive source are exponentially distributed. A source and detector drive a probability unit which reduces the input distribution rate

parameter by as much as two decades. The origin parameter is then introduced by a gating circuit which eliminates pulses which follow their predecessors by less than a specified number of seconds. The system is reliable, and easily calibrated and adjusted. Author (TAB)

N70-13012# Oak Ridge National Lab., Tenn.
NEUTRON INDUCED BACKGROUND EFFECTS IN GAMMA-RAY SPECTROMETERS FOR USE IN SPACE
R. L. Macklin 12 Aug. 1969 16 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2675) Avail: CFSTI

An introduction to neutron shielding problems for a gamma-ray spectrometer operating in the upper atmosphere or in space is given. Attention is focused on gamma-ray background production from 50 keV to a few MeV, the region where characteristic nuclear gamma-ray lines are found. A specific example of a spectrometer shield was designed, constructed, and tested for effectiveness with pulsed neutrons. Author (NSA)

N70-13023# Sandia Corp., Albuquerque, N. Mex. Dikewood Corp., Albuquerque, N. Mex.
INTEGRATION OF A DIGITAL COMPUYER WITH A VERTICAL BALANCING SYSTEM ON A REAL-TIME BASIS
Glenn R. Elliott, George R. Norris, Jr., and Sam D. Stearns May 1969 25 p Presented at the 28th Ann. Conf. of the Soc. of Aeron. Weight Engr., San Francisco, 5–8 May 1969 Prepared jointly with Dikewood Corp.
(PB-184722; SC-R-69-1266) Avail: CFSTI CSCL 14B

The paper describes the combination of a PDP8 digital computer with a Trebel balancing machine to produce real-time presentation of trim weights and their position. Author (USGRDR)

N70-13025# Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).
SOME USEFUL DATA FOR Li-6 SEMI-CONDUCTOR SANDWICH SPECTROMETERS
G. de Leeuw-Gierts and S. de Leeuw May 1968 67 p refs
(BLG-428) Avail: CFSTI

Reaction kinematics are discussed and some useful formulas derived. Spectrometer resolution as well for sum coincidence work as for triton spectrometry. Theoretical calculations are made under the fundamental hypotheses of an isotropic neutron flux distribution and numerical examples are worked out using a simple range-energy relation. Good qualitative agreement with experimental data is observed but difficulties arise for a quantitative comparison. This can to a certain extent be explained by the approximations made and errors on the range data used but the major difficulties arise from target inhomogeneities. Geometrical efficiencies are calculated for two practical spectrometer designs, i.e., the 2 pi sandwich and the energy independent collimation. The latter is of particular interest in that the efficiency is a constant for a given spectrometer design and no corrections are necessary if there is no need for absolute flux measurements. Author (NSA)

N70-13078*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
THE COUNTERBALANCING OF ACCELERATIONS IN A SKIN FRICTION METER
Richard Grant Ashby *In its* A Force Balance System for the Meas. of Skin Friction Drag Force in the Presence of Large Vibrations and Temp. Sep. 1969 88 p refs (See N70-13075 03-15)
Avail: CFSTI CSCL 14B

Design considerations for an acceleration insensitive skin friction meter are described. The meter, which is to be mounted in a free flight aircraft, is made insensitive to accelerations by using a counterbalancing technique. The counterbalanced system consists of two components which are free to rotate and are connected by crossed metal bands. A theoretical and experimental analysis is performed to determine the effects of any existing rotational spring rate of the crossed metal bands. Finally, recommended band sizes, which are based on a stress analysis, are given. Author

N70-13082*# Texas Univ., Dallas.
COSMIC RAY PARTICLE DETECTORS DESIGNED FOR INTERPLANETARY STUDIES UTILIZING THE PIONEERS 8, 9, AND 10 SPACECRAFTS Final Report
R. P. Bukata, E. P. Keath, and J. M. Younse Oct. 1969 41 p refs
(Contracts NAS2-3332; NAS2-4674)
(NASA-CR-73388) Avail: CFSTI CSCL 14B

This report briefly summarizes the design, development, fabrication, and initial data reduction history of the cosmic ray detector packages for the Pioneers 8–10 deep-space probe missions. This report is intended to supplement 8, 9, and 10 missions. Discussed are the three somewhat general catagories: (1) the time-history of the program development; (2) a description of the particle detectors, along with preliminary data obtained from Pioneer 8; and (3) techniques employed in the reduction of the scientific data telemetered back to earth. Author

N70-13091# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
INSTRUMENT FOR MEASURING ULTRA VIOLET EXPOSURES
R. V. Osborne Sep. 1969 20 p
(AECL-3384) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Attachment of an integrator to an ultra violet detector allows accurate measurement of ultra violet doses during biological exposures. The integrator may be set so that when a predetermined dose has been delivered the UV source is switched off or a shutter closed. The accuracy of integration is within 1 per cent which is better than that of the UV detector. Variation of the integrator calibration with temperature is negligible. Procedures for using and calibrating the integrator are given. Author

N70-13094*# Norton Research Corp., Cambridge, Mass.
RESEARCH AND DEVELOPMENT PROGRAM ON ORBITRON ULTRAHIGH VACUUM GAUGE
F. J. Brock Washington NASA Dec. 1969 79 p refs
(Contract NAS1-5347)
(NASA-CR-1479) Avail: CFSTI CSCL 14B

Mathematical procedures are outlined to obtain a self-consistent solution for the space charge dependent potential distribution of the orbitron gage. A computer program was used to obtain a set of geometric and electrical parameters for developing an orbitron gage. Author

N70-13123# Monterey Research Labs., Calif.
INSTRUMENTATION FOR A HUMAN OCCUPANT SIMULATION SYSTEM
W. I. Kipp *In* NRL Shock and Vibration Bull., No. 39, Pt. 5 Dec. 1968 p 89–96 refs (See N70-13112 03-32)
Avail: CFSTI

A description is given of the instrumentation system for a machine which simulates the upper body motion of a lap-belt-restrained human during vehicle impact. The system incorporates measurement techniques not found in standard data acquisition equipment. Among these techniques are a method to reduce oscillations on accelerometer data without filtering, a simple velocity measurement scheme, and a method to obtain readable oscillograms of high frequency FM data. Most of these techniques can be directly applied to other instrumentation problems. Author

N70-13250# Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC FLOWMETER FOR HIGH-TEMPERATURE OPERATION

Herbert Kartluke Jul. 1969 70 p refs
(Contract AT(30-1)-3622)
(NYO-3622-25) Avail: CFSTI

An ultrasonic flowmeter, developed for use in a high-temperature reactor flow system, provided for transmission of an ultrasonic signal from a side-entry probe and reception by probes located upstream and downstream from the transmitter is described. Flow rate was determined by differences of relative phase angle of the received signals. The flowmeter was tested and calibrated at a temperature of 1200 F in a molten sodium test loop at Mine Safety Appliances Research Corporation. Satisfactory operation was demonstrated, with little scatter in the calibration data and without restriction of the flow channel. Author (NSA)

N70-13365*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-TEMPERATURE TRANSIENT PRESSURE TRANSDUCER FOR USE IN LIQUID-METAL SYSTEMS
Ted W. Nyland and Richard E. Chase Washington Dec. 1969 10 p refs
(NASA-TN-D-5589) Avail: CFSTI CSCL 14B

The design and testing of a high-temperature transient pressure transducer is described. It is capable of operating at 1090 K (1500 F) in the presence of a liquid metal. The range of the transducer is 0 to 69 N/sq cm (0 to 100 psi) with a useful response to 200 Hz. Sensitivity of the transducer is 8 pC/(N)(sq cm) (5.5 pC/psi). Two transducers were tested at 1090 K (1500 F) for greater than 1100 hr. Author

N70-13370# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
INSTRUMENT DEVELOPMENT BRANCH, 1968 Annual Report
R. G. Morrison, ed., J. B. Colson, comp., S. R. Gossman, comp., and N. Wilde, comp. Jul. 1969 128 p refs
(Contract AT(10-1)-205)
(IDO-17299) Avail: CFSTI

Progress in instrument development is reviewed including work on: (1) a low level dc amplifier for use with thermocouples, (2) a feedback compensated linear variable differential transformer for displacement measurements in the LOFT reactor, (3) an ultrasonic anemometer for steam convection current measurement in the LOFT reactor, (4) a capacitance level indicator for dielectric materials, (5) high-temperature, high-pressure, nonwettable feedthrough seals and glands, (6) strain gages for pressurized steam atmospheres, and (7) a 100-channel analog data multiplexer. Other tasks discussed include computer simulation of iodine-131 distribution in cattle; eddy current system for measuring transient diametrical growth and fuel rod temperature and for detecting departure from nucleate boiling; fuel element cladding; steam emergency core cooldown effects on Zircaloy response; fuel temperature measurements during fuel element flooding in LOFT reactors; stress wave analysis instrumentation, and saturation conditions simulation in a steam generator. J.A.M.

N70-13381# General Electric Co., Philadelphia, Pa. Missile and Space Div.
RESEARCH ON AVALANCHE TYPE SEMICONDUCTOR RADIATION DETECTORS Semiannual Report, Jan.-Jun. 1969
Gerald C. Huth, Robert J. Locker, Peter V. Hewka, and Vincent L. Gelezunas Jul. 1969 66 p
(NYO-3246-TA-5) Avail: CFSTI

Research to minimize the resistivity nonuniformity and thus to achieve high average gain with low gain spread, and good energy resolution is described. Avalanche detector applications can then be extended from nuclear radiation and photon counting to high resolution spectroscopy. Also, a summary of the present level of knowledge and understanding of the performance and characteristics of the avalanche detector – tunnel diode circuit configuration, and of the underlying physical processes which determine this performance is presented. Included in this review is a brief summary of avalanche detector characteristics and physical properties, with emphasis on those aspects which affect circuit performance. NSA

N70-13382# Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF PHOTOGRAMMETRIC TECHNIQUES FOR CENSUSING SEA OTTERS
Joachim G. Stephan 22 Jul. 1969 18 p
(Contract AT(26-1)-171)
(BMI-171-119) Avail: CFSTI

Tests were conducted on Amchitka Island, Alaska to permit a comparison of visual and photographic censusing of sea otter (and other) populations. An evaluation of the photography obtained over Amchitka led to the conclusion that sea otters may be readily distinguished in aerial photographs by a skilled photo interpreter. Censusing through aerial photography in marginal weather areas such as Amchitka may best be performed using the Ektachrome Infrared Aero Film Type 8443. When correctly exposed, this film renders the sea otters black against a background of a bright, almost flaming, red when they are resting in the kelp beds surrounding the island. When in the water, the animals appear black against a light blue ocean in silhouettes very characteristic of the sea otter. Photo counts in this test exceed visual counts by about 50 percent in areas where there are many animals lying in the kelp beds. Stereo photography provides an advantage, especially when marginal photography is viewed. Large-format photography (9 inch square photos) is best suited for photographic recording of large areas. Author (NSA)

N70-13391# Georgia Inst. of Tech., Atlanta
SPARK COUNTER NEUTRON DETECTOR FOR HIGH-TEMPERATURE APPLICATIONS Final Report
Geoffrey G. Eichholz Jun. 1969 56 p refs
(Contract AT(40-1)-3563)
(TID-25196) Avail: CFSTI

Spark counters of the corrugated electrode type were designed and tested for use as neutron detectors in high neutron fluxes and at high temperatures. These detectors consist of a gas-filled coaxial assembly, in which circular ridges, acting as spark gap electrodes with the cylindrical outer container, are interleaved with boron-containing disks, which act as neutron converters by producing alpha particles. These alpha particles trigger a spark across the gap, producing a large current pulse that is readily detected and counted. With argon or helium gas fillings, such counters were operated at temperatures up to 1076 F at which point the leakage currents across the ceramic insulator seals became excessive. The counters were tested in a wide range of neutron fluxes. The counters were found to have a linear response in neutron fluxes in the presence of gamma-ray fields of the order of 10,000 R/hr. Above that level the response became increasingly nonlinear as gas ionization due to primary and secondary gamma-rays became significant and ultimately suppressed the spark mechanism. Author (NSA)

N70-13394# Sandia Corp., Albuquerque, N.Mex.
FLOW CALORIMETER FOR THE TESTING OF CATALYSTS AND FOR THE DETERMINATION OF THE HEAT OF FORMATION [STROEMUNGS CALORIMETER ZUM TESTEN VON KATALYSATOREN UND ZUR BESTIMMUNG VON KILDUNGSWAERMEN]
H. Kral 9 Sep. 1969 11 p Transl. into ENGLISH from Glas-Instr.-Tech., (Darmstadt), v. 7, 1967 p 699 702
(PB-186094T; SC-T-69-1041) Avail: CFSTI CSCL 14B

A recently developed dynamic calorimeter can be utilized as a universal test equipment for catalysts. Moreover, the heat of formation can be measured. The very simply constructed apparatus also allows rapid routine measurements. Author (USGRDR)

N70-13427# Naval Ordnance Lab., White Oak, Md.
THE VIDEO TAPE RECORDING OF ULTRASONIC TEST INFORMATION Final Report
Robert A. Youshaw, Charles H. Dyer, and Edward L. Crisuolo Oct. 1968 23 p refs Sponsored by US Coast Guard
(Order PO-6-0039)
(AD-677894; SSC-189) Avail: CFSTI CSCL 14/3

A video tape recorder was converted into a wide band instrumentation recorder. The 'A' scan from the ultrasonic tester is directly recorded, together with the operator's voice giving the location, transducer position and interpretation of test data. An oscilloscope is used for the playback. The circuitry necessary to couple the output of the ultrasonic tester to the tape recorder is described. Author (TAB)

N70-13435# Atomic Energy Commission, Washington, D.C. Technical Information Div.
CALORIMETRIC MEASUREMENT OF SUPERHIGH-FREQUENCY POWER [KALORIMETRICHESKIY IZMERITEL MOSHCHNOSTI SVCH]
L. E. Tsopp Aug. 1969 14 p refs Transl. into ENGLISH from Russian Report NP-17749
(AEC-tr-7068; NP-17749) Avail: CFSTI

Descriptions are given of a circulating calorimeter used with the Ramus-2 installation, designed for studying radiative acceleration of plasma. The calorimeter is capable of measuring the mean power from 10 to 200 W, with an accuracy of + or - 5%, at pulsed power exceeding 1 MW. Alcohol is used as the thermometric liquid with a sensitive thermopile enabling calibration according to dc power. NSA

N70-13460# Akademiya Nauk URSR, Kiev.
AN APPARATUS FOR ELECTRIC GEOPHYSICAL PROSPECTING BY THE ELLIPTICALLY POLARIZED FIELD METHOD
A. M. Briskin, L. Ya. Mizyuk, V. M. Podzharyy, and R. V. Prots *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 70-92 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

A transistorized portable field apparatus is described for measuring the semiaxis of projecting the polarization ellipse of a magnetic field onto the plane of a profile being investigated by the inductive method. Field studies show that the apparatus can be used for geological mapping of rocks with a specific resistance from 20 to 10,000 ohms per meter, for shallow sounding, and for direct exploration of good-conducting ore deposits at depths to 150 meters. The apparatus was improved after field tests. Transl. by R.B.

N70-13550# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PRELIMINARY ADJUSTMENT OF CRYSTAL FRAGMENTS FOR THE PROCESSION CAMERA USING LAUE PATTERNS
Priscilla W. Kingman Sep. 1969 12 p refs
(AD-693780; BRL-TN-1719) Avail: CFSTI CSCL 20/2

A technique for the preliminary orientation of crystals for the precession camera is described. The method is primarily for the adjustment of crystal fragments which cannot be aligned by optical methods, and is designed to avoid the use of elaborate plotting procedures. A simple device for adapting the binocular microscope crystal stage for X-ray examination is also described. Author (TAB)

N70-13573# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Plasmaphysik.
PIEZOELECTRIC SONDE FOR MEASURING SMALL PRESSURE PULSES IN PLASMAS [PIEZOELEKTRISCHE SONDE ZUR MESSUNG KLEINER DRUCKPULSE IN PLASMEN]
Karl Heinz Finken Jul. 1969 43 p refs In GERMAN
(JUL-607-PP) Avail: CFSTI

Developed was a piezoelectric pressure sensor for measuring small pressure fluctuations in plasmas. Incorporation of an amplifier into the instrument increased its sensitivity about five times as compared with usual pressure sensors. The sensor was calibrated on a plasma jet of known characteristics. Transl. by G.G.

N70-13600# Atomics International, Canoga Park, Calif.
SYSTEMS QUALITY SODIUM LOOP: OXYGEN METER CALIBRATION
E. W. Murbach and N. W. Heath 27 May. 1969 11 p refs
(AI-AEC-Memo-12848) Avail: CFSTI

An experiment to calibrate the electrochemical oxygen meter installed in the systems quality sodium loop is described. The cold trap was valved out of the loop and three injections of oxygen were made by addition through the cover gas. The oxygen was rapidly dissolved by the sodium as shown by a decrease in the oxygen meter output. The plugging meter was operated in the oscillating mode to estimate saturation temperatures of the dissolved oxygen. Several samples were taken from chemical analysis. The equation E = 1.174 - 0.0545 log C where E is in volts and C is wppm oxygen, was developed from the experimental results. Author (NSA)

N70-13601# Atomics International, Canoga Park, Calif.
TRANSIT TIME FLOWMETER EMPLOYING NOISE ANALYSIS TECHNIQUES. PART 1: WATER LOOP TESTS
R. L. Randall [1969] 117 p refs
(Contract AT(04-3)-701)
(AI-AEC-12802) Avail: CFSTI

Recent improvements in commercially available cross correlation measurement equipment have led to the development of a transit time flowmeter for use in calibration of, or as an alternative to, conventional methods for flow measurement in liquid metal. The technique is based on the detection of thermal eddies at two points separated a known distance in a flowing stream and measurement of the average transit time of the fluid between the sensors by cross correlation. Detailed descriptions are presented of the technique, instrumentation, and results of tests in a water loop. Future tests will include tests in 1200 F sodium. Author (NSA)

N70-13605# British Aircraft Corp., Filton (England).
SPECULATIONS ON THE APPLICATION OF PATTERN RECOGNITION TECHNIQUES TO EARTH RESOURCE SATELLITE DATA
B. M. Watrasiewicz and M. P. Barton [1969] 9 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14-25 Jul. 1969
Avail: CFSTI

Two techniques for automatic speech recognition and two for the automatic tracking of moving objects which have been studied by the authors may have application to the processing of data from earth resource satellites. Author (ESRO)

N70-13656 Defense Research Establishment Toronto, Downsview (Ontario). Defense Research Board.
EVALUATION OF A DIRECT READING INSTRUMENT FOR MEASURING THE WET BULB-GLOBE TEMPERATURE INDEX
L. A. Kuehn Sep. 1968 29 p refs
(DRET-692) Avail: Issuing Activity

Described is a globe thermometer for measuring the wet bulb-globe temperature index. The instrument consists of a thermometer placed with its bulb at the center of a hollow blackened metal sphere. When a constant radiant heat load is imposed on the globe thermometer, an equilibrium is reached between heat transfer by radiation and by convection of air over the globe, and

the globe temperature differs from the dry bulb temperature. Thus, radiation temperature, dry bulb temperature and air movement are effectively combined in globe temperature. The effect of water vapor pressure on evaporative heat loss is recognized in the natural wet bulb temperature. The combination of a direct measure of dry bulb temperature, radiant temperature and natural wet bulb temperature leads to a single value called the Wet Bulb-Globe Temperature (WBGT), which takes into account the four thermal environmental variables most relevant to heat stress in man.
Author

N70-13673# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
PRECISE IN-FLIGHT SYNCHRONIZATION OF GROUND STATIONS [SYNCHRONISATION PRECISE DE BASES PAR SIMPLE SURVOL]
Jean Besson and Joseph Cumer 1969 26 p refs In FRENCH; ENGLISH summary Presented at the Intern. Colloq. on Chronometry, Paris, 16–20 Sep. 1969 Submitted for publication
(ONERA-TP-759) Avail: CFSTI

Clocks located at outlying ground stations e.g. observatories, test stations, beacons, etc., can be synchronized by comparing their time scales with that sent out by an overflying aircraft. This method is described by outlining a comparative operation between the times of the Paris and Brunswick Observatories.
Author (ESRO)

N70-13682# United States Lake Survey, Detroit, Mich. Corps of Engineers.
THE ZEISS APPARATUS FOR CROSSING WATER SPANS IN PRECISE LEVELING
Ralph Moore Berry Oct. 1969 61 p refs
(AD-694358; MP-69-6) Avail: CFSTI CSCL 20/6

One of the serious problems encountered in precise leveling is the crossing of water spans which are wider than the maximum sight-distance specified for the order of accuracy desired. This problem is met with some variation of a water-crossing technique which usually involves the two following principles: reciprocal observations, and controlled tilting of the line of sight. Instrumentation to accomplish this measurement is described.
TAB

N70-13732# Naval Research Lab., Washington, D.C.
A DESIGN OF A CONSTANT TEMPERATURE CHAMBER
Alan W. Baldwin Aug. 1969 7 p
(AD-694456; NRL-MR-2032) Avail: CFSTI CSCL 14/2

A requirement for an effective constant ambient temperature chamber for a precision oscillator clock led to the development of the apparatus described in this report. A temperature variation smoothing ratio of 30 to 1 with a 5 hour lag was readily achieved with this inexpensive and simple apparatus.
Author (TAB)

N70-13744# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.
DEVELOPMENT OF AN ABSOLUTE DISPLACEMENT TRANSDUCER Final Report
J. M. Richter Jul. 1969 25 p ref
(Contract AT(29-1)-1183)
(EGG-1183-3004) Avail: CFSTI

A prototype model of an absolute vertical displacement transducer for use in earth motion measurements has been constructed and tested. The transducer consists of an internal reference mass which is counterbalanced against gravity by a constant-force Negator spring motor. The prototype transducer has a peak-to-peak displacement range of 15 inches, a resolution of 0.167 percent of full scale or 0.025 inch, a sensitivity of 0.0127 volts/volt-inch, and is linear within + or − 1 percent of full scale. The 3-dB low-frequency cutoff for a sinusoidal displacement of a 1.5-inch amplitude is 0.35 Hz. However, for frequencies below 2 Hz, there is an amplification of the output and a phase difference between the input and the output. Factors affecting the low- and high-frequency cutoffs, as well as other factors affecting the overall system response, are discussed.
Author (NSA)

N70-13747# Sandia Corp., Livermore, Calif. Material Science Div.
DYNAMIC CALIBRATION OF ALUMINUM HONEYCOMB
R. N. King and M. D. Meyer Aug. 1969 30 p
(Contract AT(29-1)-789)
(PB-185715; SCL-DR-69-53) Avail: CFSTI CSCL 14B

Calibration data are given for three strengths of aluminum honeycomb used in impulse-measuring gages. The distance of crush was found to be nearly proportional to the kinetic energy of the projectile. Strain rate and elastic effects are thought to account for the slight increase in strength at high velocities and low projectile masses.
Author (USGRDR)

N70-13757# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
PROGRAMMING AND DETECTION OF ACTIVITY IN AN ON-LINE ISOTOPE SEPARATION COLLECTOR [PROGRAMMATION ET DETECTION DE L'ACTIVITE OBTENUE AU COLLECTEUR D'UN SEPARATEUR D'ISOTOPES 'EN LIGNE']
Jean Crancon, Michel Guisset, and Christian Riatori Aug. 1969 20 p refs In FRENCH; ENGLISH summary
(CEA-R-3843) Avail: CFSTI

A device for programming irradiation, counting and printing times, to be used in connection with on-line isotopic separation studies is described. A fast mechanical transporting aluminum ribbon (0.4 m/s) was used to transfer the collected activity to the low background counting place. The working parameters can be suited to short half-lives (down to a few seconds) as well as for neutron induced uranium fission yields.
Author (ESRO)

N70-13777# Colorado Univ., Boulder.
DESIGN AND PERFORMANCE OF A TRANSPORT SOLENOID Si(Li) DETECTOR CONVERSION ELECTRON SPECTROMETER FOR ON LINE USE WITH ACCELERATORS
B. Klank and R. A. Ristinen Aug. 1969 18 p refs Presented at the Intern. Conf. on Radioactivity in Nucl. Spectry.
(Contract AT(11-1)-535)
(COO-535-599; CONF-690818-1) Avail: CFSTI

The design and performance of an internal conversion electron spectrometer incorporating a solenoidal magnetic field along the target – detector axis for transporting electrons from a target placed in an accelerator beam to a cooled lithium-drifted silicon detector are described. An energy resolution of approximately 3 keV fwhm was obtained for electron lines over a wide range of energies.
NSA

N70-13810# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
SOFT X-RAY DATA ACQUISITION AND HANDLING Technical Report, Jan. – Dec. 1968
William L. Baun Aug. 1969 31 p
(AD-694060; AFML-TR-69-56) Avail: CFSTI CSCL 14/2

The fine features of x-ray emission spectra, including band shapes and intensities, are being used more and more for identification of unknown materials, especially using the electron microbeam probe. Advances in electronics have facilitated x-ray emission data acquisition and improvements in data handling and computer techniques have allowed curve analysis and data reduction that could not be attempted by hand calculation methods. Data collection systems are described. In one system, the x-ray detector and dispersing crystal are advanced in steps by a precision stepping motor which is interconnected with the stepper control, printing

timer, printing scalar, print control, teletype and paper tape output. In another system, a multichannel analyzer is used in a multiscaler mode. In both systems the paper tape is converted to magnetic tape which is fed into the computer and a data sheet for each spectrum is printed. From these data sheets, line or point by point plots, linear in either wavelength or energy, may then be prepared by the computer for any selected spectrum. Examples, using AlK, MgK, and CuL and other spectra, are shown using the systems described above. Aspects such as improvements in curve analysis and the use of wavelength and energy converter modules are discussed. Author (TAB)

N70-13818# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

MASMA: A VERSATILE MULTIFUNCTIONAL UNIT (GATED WINDOW AMPLIFIER, ANALOG MEMORY AND HEIGHT-TO-TIME CONVERTER) [ELEMENT MULTIFONCTIONNEL MASMA (MODULE AMPLIFICATEUR A SEUIL, MEMOIRE ANALOGIQUE ET CONVERTISSEUR AMPLITUDE-TEMPS)]

Vsevolod Goursky and Pierre Thenas Oct. 1969 45 p refs In FRENCH; ENGLISH summary
(CEA-R-3897) Avail: CFSTI

This multipurpose unit is designed to act as a gated window amplifier, an analog memory or a height-to-time converter. The first function is mainly intended to improve the poor resolution of pulse-height analyzers with a small number of channels. The analog memory, a new function in the standard range of plug-in modules, is capable of performing a number of operations such as serving as a fixed delay, or variable delay dependent on an external parameter (application to the analog processing of non-coincident pulses), or a derandomizer to increase the efficiency of the pulse-height analysis in a spectrometry experiment, or a linear multiplexer to allow an analyzer to serve as many spectrometry devices as memory elements that it possesses. Associated with a coding scaler, this unit, if used as a height-to-time converter, constitutes a Wilkinson ADC with a capability of 10 bits (or more) and with a 100 MHz clock frequency. Author (ESRO)

N70-13830# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).

AUTOMATIC AIMING SYSTEM FOR LASER RANGE-FINDERS [SYSTEME DE POINTAGE AUTOMATIQUE POUR TELEMETRE A LASER]

Roland Moreau 1969 13 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on Opto-Electron. Tech. of Signal Process., Tonsberg, Norway, 29 Sep.-3 Oct. 1969 Submitted for publication
(ONERA-TP-761) Avail: CFSTI

The range finding of moving bodies in space through Q-switch lasers entails aiming the transmitter with increasing accuracy as the beam divergence decreases. Usually this operation is performed by an aiming device pointing towards the target through the telescope cross-hairs; in some cases the mount carrying the transmitter and the receiver is controlled by radio-frequency radar or infrared trackers. The device presented in this paper uses the directional information carried by the light beam transmitted by the laser and reflected by the target. The receiving unit comprises a telescope at the focus of which is installed a deviation measuring device made of five photomultipliers. The detection and calculation logic is organized in order to optimize the mount control, taking into account the low rate of recurrence of the laser signal, the possibility of an occasional gap in the echoes, the problems arising from target acquisition and the possibility of introducing some complementary information not originating the echoes themselves. The main characteristics of such a device are presented and its advantages discussed. Author (ESRO)

N70-13941# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).

CASSIOPEE, AN ATTITUDE CONTROL DEVICE: FIRST FLIGHT TESTS [DISPOSITIF DE CONTROLE D'ATTITUDE CASSIOPEE: PREMIERS ESSAIS EN VOL]

André Rémondière 1969 9 p refs In FRENCH; ENGLISH summary Presented at the 20th Intern. Astronautics Congr., Mar del Plata, Arg., 6–10 Oct. 1969 Submitted for publication
(ONERA-TP-762) Avail: CFSTI

Following a complete descriptive article published in the French journal l'Astronautique et l'Aéronautique no. 12 (5–1969), this paper presents the detailed results of the first flight test, during which the nose cone of the TACITE rocket pointed towards the centre of the sun and then explored the solar disc and its neighbourhood. The programme of the second test foreseen for November 1969 on a VESTA rocket is described; it will include successive orientations towards several stars or predetermined directions. Author (ESRO)

N70-13947# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

DOSAGE OF SILICON IN A SOLUBLE SILICATE USING AN X-RAY FLUORESCENCE RADIOISOTOPIC METHOD [DOSAGE DU SILICIUM DANS UN SILICATE SOLUBLE PAR UNE METHODE RADIOISOTOPIQUE DE FLUORESCENCE X]

Marta Wasilewska and André Robert Jul. 1969 47 p refs In FRENCH; ENGLISH summary
(CEA-R-3811) Avail: CFSTI

A description is given of a spectrometer for X-ray fluorescence analysis having a radioactive excitation source which has been applied to the analysis of the silicon contained in an industrial soluble silicate. A theoretical study was made of the operational conditions such as the effect of the particle size, the dilution of the sample and the sensitivity as a function of the X-ray excitation energy. It is possible to obtain a relative accuracy of 0.87 per cent for the silicon determination, for one standard deviation. A comparison is made of the silicon determination sensitivity obtained with this apparatus with that of a conventional apparatus fitted with an X-ray tube. Author (ESRO)

N70-14019# Rome Univ. (Italy). Inst. of Physics.

REAL TIME CONTROL BY MEANS OF AN IBM 1800 COMPUTER OF MEASURING TABLES FOR BUBBLE CHAMBER PHOTOGRAPHS [CONTROLLO IN TEMPO REALE MEDIANTE UN ELABORATORE ELETTRONICO IBM 1800 DI TAVOLI DI MISURA PER FOTOGRAMMI DI CAMERA A BOLLE]

G. F. Bagella, A. Orlandani, and A. Rambaldi 29 Apr. 1969 24 p In ITALIAN Prepared jointly with Ist. Nazl. di Fis. Nucl. *Its* Nota Interna No. 219
Avail: CFSTI

The system of real time control of the measuring tables associated with the bubble chamber of the National Institute of Nuclear Physics, Rome, is described. This system permits an increase in the efficiency, accuracy and speed of bubble chamber photograph evaluation. It consists of four tables, an IBM 1800 computer with a disk storage unit, and several other peripheral devices. The operation of the system is described in detail by means of flow charts. ESRO

N70-14021# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

ALPHA EMITTERS MESUREMENT BY DEFINED SOLID ANGLE METHOD [MEASURE DES EMITTEURS ALPHA PAR LA METHODE DE L'ANGLE SOLIDE DEFINI]

Jean-Pierre Perolat and Jeanne Gorry Oct. 1969 20 p refs In FRENCH; ENGLISH summary
(CEA-R-3899) Avail: CFSTI

The principle of absolute measurement for alpha particles is described. Scattering, backscattering and absorption corrections are reviewed as well as the different sources of errors of this method. Two low geometry counters are used, the first with a geometry

factor of about 2 × 10 to the minus 2 power. On the second counter, with a suitably designed detection head, it is possible to choose one of the four geometry factors. The comparison of these two counters and the comparison of the first of them with a 4 pi alpha-gamma coincidence system confirm the fact that this method allows accuracies better than 0.2 per cent to be obtained.
Author (ESRO)

N70-14058# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
MEASUREMENTS OF SKIN FRICTION IN BLOWDOWN HYPERSONIC WIND TUNNELS [MESURE DE FORCE DE FROTTEMENT DANS DES OUFFLERIES HYPERSONIQUES A RAFALES]
Jean-Pierre Chevallier 1969 9 p refs Presented at the 32nd Meeting of the Supersonic Tunnel Assoc., Stockholm, 18–19 Sep. 1969 Submitted for publication
(ONERA-TP-756) Avail: CFSTI

A device has been developed to measure local skin friction on a model. The floating element, mounted on a special elastic set up, moves in its plane; the measurement of its displacement by means of a variable reluctance yields forces between 103 and 101 N (0.1 to 10 g). Some results obtained at Mach 7 and 10 on a flat plate in the transition region and on a wedge as a function of the angle of attack are presented.
Author (ESRO)

N70-14062# RAND Corp., Santa Monica, Calif.
PSEUDOCOLOR ENHANCEMENT OF BIOMEDICAL IMAGES
Joseph J. Sheppard, Jr., Roy H. Stratton, and Carl Gazley, Jr. Sep. 1969 12 p refs Presented at the 1st Intern. Colour Congr., Stockholm, 9 – 13 Jun. 1969
(AD-693922; P-4104) Avail: CFSTI CSCL 14/5

For human observers, the number of distinguishably different colors is much larger than the number of distinguishably different shades of gray. Therefore, if the scale of grays in a complex black-and-white image is transformed into some suitable scale of colors, perception of the details in that image will be greatly enhanced. In one versatile but expensive method of producing such pseudocolor images, the black-and-white image is photoelectrically scanned and a computer used to produce three pseudocolor separations on 35-mm film. A simpler and inexpensive method uses purely photographic procedures. Examples of pseudocolor enhancements are presented.
Author (TAB)

N70-14063# RAND Corp., Santa Monica, Calif.
SPACE PHOTOGRAPHY AND THE EXPLORATION OF MARS
Bruce C. Murray (Calif. Inst. of Tech., Pasadena) and Merton E. Davies Sep. 1969 42 p refs Prepared in cooperation with Calif. Inst. of Tech., Pasadena
(AD-693923; P-4120; CONTRIB-1642) Avail: CFSTI CSCL 14/5

The photographic exploration of Mars, and that of all temporally varying planets, is a multi-variable process in which surface resolution, geographic coverage, and observation time are all of importance. Thus, the conception and design of photographic missions is concerned with the balancing of these and other factors against the total photographic data that can be returned from the spacecraft. This paper emphasizes photography as a communication process in which information flows from the object being studied to the minds of scientists on the ground. It attempts to place this process in a quantitative framework, drawing examples from the exploration of Mars but indicating applications elsewhere as well. The concluding section is concerned with how best to proceed further with the photographic exploration of Mars as well as the question of balance between the exploration of Mars and the rest of the solar system.
Author (TAB)

N70-14078# Michigan Univ., Ann Arbor. Willow Run Lab.
SPECTRAL SIGNATURES AND MEASUREMENTS
Donald S. Lowe *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 21 p refs (See N70-14072 03-13)
Avail: CFSTI

Methods for measuring the spectral characteristics of materials are discussed, as well as advantages and problems involved in making these measurements in the laboratory and in the field. Spectral measurement programs being utilized in earth resource activities are also treated. The three types of spectrometers used in measuring reflected, scattered, transmitted, or emitted radiation are identified as (1) filter wheel spectrometers; (2) dispersing spectrometers using gratings and prisms; and (3) interferometer spectrometers. Choice of the type of instrument to use for a particular application depends upon a number of design and operational parameters; factors which may influence the selection of a spectrometer for a given job are given. Finally, calibration problems and techniques utilized in the laboratory and field are treated.
A.C.R.

N70-14079# Purdue Univ., Lafayette, Ind. Data Group.
ON PATTERN RECOGNITION
G. P. Cardillo and David Landgrebe *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 18 p (See N70-14072 03-13)
Avail: CFSTI

A non-mathematical discussion of automatic pattern recognition techniques and their application is presented. The basic model of a pattern recognition device consisting of a receptor and a categorizer is discussed, as are a number of approaches to the solution of pattern recognition problems. It is seen that although the fields of application are very diverse, important properties of each problem can be extracted and formulated within a common framework.
Author

N70-14083# California Univ., Riverside.
MAKING COLOR INFRARED FILM A MORE EFFECTIVE HIGH ALTITUDE SENSOR
Robert W. Pease and Leonard W. Bowden *In its* Remote Sensing of the Environ. Aug. 1968 35 p refs (See N70-14072 03-13)
(SR-2; TR-1) Avail: CFSTI

A method for overcoming problems in utilizing color infrared transparency film is described. Problems related to high altitude use stem from the face that in presently designed film the layer which controls appearance of red in the positive transparency has been reduced in sensitivity, so that subtle differences in the infrared reflectance of nearby objects can be recorded in contrasting colors. The condition is overcome by adding a system of auxiliary filters to the basic minus-blue filters recommended by the manufacturer. The record of infrared reflection is enhanced with respect to the rest of the image so that there is no problem in obtaining the red colors from high altitudes which identify the most subtle blushes of growing vegetation. Exposure is less critical, since mild underexposure still retains red tones; feasibility testing by a number of users with 35-mm cameras indicates a high degree of reliability when simple instructions are followed.
A.C.R.

N70-14094# Barringer Research, Ltd., Rexdale (Ontario).
REMOTE SENSING CORRELATION SPECTROMETRY FOR POLLUTION MEASUREMENT
A. R. Barringer and B. C. Newbury *In* Calif. Univ. Remote Sensing of the Environ. Aug. 1968 15 p Presented at the 9th Conf. on Methods in Air Pollution and Ind. Hyg. Studies, Pasadena, Calif. 7-9 Feb. 1968 (See N70-14072 03-13)
Avail: CFSTI

A correlation spectrometer is described that offers an electro-optical technique for real-time correlation analyses of a predetermined component by simple optical means; this in turn enables a direct readout to be obtained relating to the concentration and pathlength of that component and is of potential use in remote sensing operations involving atmospheric pollution. Applications

employing ambient light are treated in which a portable, self-contained instrument can be used for monitoring sulfur dioxide gases emitted from smoke stacks from ground level positions aboard aircraft and helicopters. The instrument may also be utilized for making real-time measurements with artificial light sources. In addition, studies have recently been initiated to measure gas concentrations with infrared correlation interferometry; a very borad range of gases, particularly oxidant-type polluants, appear suitable for detection by long path measurements in the infrared. Finally, research on applying correlation spectrometry to monitoring air pollution from orbiting spacecraft is also continuing under NASA contract. A.C.R.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-12752# Union Carbide Corp., Oak Ridge, Tenn.
VACUUM PUMP EXPLOSION
H. C. Hoy, J. M. Googin, C. R. Schmitt, J. R. De Monbrun, and W. H. Stanton 2 Sep. 1969 34 p refs
(Contract W-7405-eng-26)
(Y-1685) Avail: CFSTI

An explosion occurred in the vacuum system of an electron beam welder at the Oak Ridge Y-12 Plant. The actual initiating mechanism cannot be determined, but the explosion occurred in the discharge lines from the roughing pump. Author (NSA)

N70-12788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TABLES OF COMPONENT RELIABILITY FOR BINOMIAL REDUNDANCY APPLICATIONS
Darl D. Bien Washington Nov. 1969 105 p refs
(NASA-TN-D-5549; E-4988) Avail: CFSTI CSCL 12A

Extensive tables of component reliabilities required for a specified system reliability are presented for systems whose reliability is expressible by the binomial distribution. These six-place tables cover a range of system reliabilities from 0.80 to 0.9999 for systems of 2 to 1000 components. The short and efficient computer program used to generate the binomial reliability parameter is included together with instructions for its use. Applications of these same techniques to sampling plans and confidence intervals are also given. Author

N70-12796# California Univ., Berkeley. Lawrence Radiation Lab.
ACCELERATOR COOLING SYSTEMS
4 Apr. 1969 89 p refs
(Contract W-7405-eng-48)
(UCRL-18837) Avail: CFSTI

The behaviour of accelerator cooling systems is discussed, and an attempt is made to explain the wide variation in the reported costs of cooling systems at various accelerator laboratories. First, alternate methods of cooling are analyzed as to concept, relative functional suitability, and relative cost. Second, a brief explanation is given of the theory of cooling towers. This explanation includes illustrations of the effects of atmospheric and operating conditions on the efficiency and, hence, the cost of cooling. Third, the economic and functional effects of cooling on other accelerator components are analyzed. Fourth, equipment associated with accelerator cooling systems is briefly discussed and evaluated. This equipment includes such things as heat exchangers, piping materials, and ion-exchange systems. Fifth, tables and charts are included which list the cost of cooling system components. Author (NSA)

N70-12798# Central Mechanical Engineering Research Inst. Durgapur (India).
A 600 HP HYDRAULIC DYNAMOMETER
N. N. Naravan Rao Feb. 1968 13 p refs
(PB-185704; CMFRI-A20) Avail: CFSTI CSCL 13G

The report deals with the design and fabrication aspects of a 600 hp hydraulic dynamometer. Some test results are also reported. Author (USGRDR)

N70-12819# Department of Supply, Melbourne (Australia). Aeronautical Research Labs.
THE MACHINING OF CHROMIUM ALLOY
R. A. Wall and K. M. Mc Kenzie Dec. 1968 10 p
(ARL/ENG. FAC.-2) Avail: CFSTI

The objective is to describe investigations into the machining of chromium alloy by conventional metal cutting, grinding, and electrodischarge machining carried out at an aeronautical research facility. Author

N70-12887# Battelle-Northwest, Richland, Wash. Chemical Technology Dept.
COLD PRESSING OF ALUMINUM-RARE EARTH OXIDE COMPOSITES
H. T. Fullam May 1969 29 p refs
(Contract AT(45-1)-1830)
(BNWL-1014) Avail: CFSTI

Results of a brief study of cold pressing oxide - aluminum composites are summarized. The study originated because of a need to fabricate aluminum - Pm2O3 targets for the Pm-146 burnout program and was extended to a more general study because of the apparent advantages of the procedure. Rare earth oxide - aluminum composites can be readily compacted into mechanically stable adherent pellets by cold pressing techniques. The densities obtained are dependent on the applied pressure, length-to-diameter ratio of the pellet, and composition of the composite. If oxide density is not a controlling factor, then cold pressing of aluminum composites has many attractive features to recommend it and should be considered as a potential method for fabricating Pm2O3 into useful shapes. Author (NSA)

N70-12891# British Iron and Steel Research Association, London (England). Metallurgy Div.
LOW TEMPERATURE ROLLING OF UPPER BAINITIC STRUCTURES
D. Dulieu and J. J. Irani 1969 23 p
(PB-186176; MG-1A-30168) Avail: CFSTI CSCL 13H

An investigation was carried out on the effect of various low temperature rolling treatments on the mechanical properties of a typical upper bainitic steel. Rolling schedules and thermal treatments involving recrystallization of the austenite, and also those involving deformation without recrystallization, deformation during transformation and warm working of upper bainite have been examined. Changes in mechanical properties were correlated with changes in the microstructure. Author (USGRDR)

N70-12903# Johns-Manville Research Center, Manville, N.J.
INVESTIGATION OF SEAL MATERIALS AND CONFIGURATIONS FOR HIGH SPEED AIR CUSHION VEHICLES
H. John Reynolds, Jr. 1 Oct. 1969 84 p refs
(Contract DOT-3-0268)
(PB-186414) Avail: CFSTI CSCL 13F

Air flow characteristics through openings provided by single and multiple metal or rubber skirts (labyrinths) situated above a bed surface were established for low pressure systems up to one psig. Single skirting of both types exhibits the standard etheoretical discharge coefficient of 0.61 for sharpedged skirting. Reduced

coefficient values are obtained with multiple skirting with rapidly declining benefit over five skirts. For metal skirts, coefficients are asymptotically low at skirt spacing/opening ratios in excess of 60 for two skirts, 45 for three skirts, and 30 for five skirts. The test results indicate that rubber skirting in multiple configurations is more efficient than metal with respect to coefficient values and pressure retention between skirt spacings. Author (USGRDR)

N70-12948*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
AN EXPERIMENTAL STUDY OF THE CRYOENTRAINMENT PUMP Progress Report
J. A. Daggerhart and F. O. Smetana 13 Nov. 1969 11 p
(Grant NGR-34-002-036)
(NASA-CR-66873) Avail: CFSTI CSCL 13L

Liquid nitrogen was initially pumped into the condenser until a steady stream of liquid was exhausted through the vent line. The liquid nitrogen was allowed to vent in this manner for a period of approximately thirty minutes. The nitrogen supply was then cut off with the condenser being supplied with liquid nitrogen periodically during the course of a given experimental run. Short bursts of the pumping medium were then admitted to the pump which had been previously filled to a given pressure level with helium. The experimental procedure was then changed so that the liquid nitrogen was allowed to flow constantly from the vent line during the course of an experimental run. The partial pressure-time profile for the helium is similar in the initial stages for both procedures. The difference between the two methods of a time period greater than one minute is due to the more efficient cooling of the condensing surface with a subsequent higher retention capability for the pumping fluid and the helium. Additional bursts of the pumping fluid reduce the partial pressure with each burst. R.B.

N70-13014# National Center for Radiological Health, Rockville, Md. Technical Services Branch.
REPORT OF PRELIMINARY MEASUREMENTS OF ELECTROMAGNETIC RADIATION FIELDS NEAR MICROWAVE OVENS
D. L. Solem, D. G. Remark, R. L. Moore, R. E. Crawford, and H. J. L. Rechen Dec. 1968 40 p refs
(PB-185967; TSB-5) Avail: CFSTI CSCL 13A

Microwave ovens are now being sold for domestic use in increasing numbers. The ovens should be designed to prevent the propagation of potentially harmful electromagnetic energy fields outside the oven. The report presents preliminary data on electromagnetic radiation power density measurements near operating microwave ovens currently on the market. The reported power density levels were obtained from existing commercial instrumentation for which a far field calibration only was available. Microwave exposure levels under various modes of safety-feature failure were determined. Commercially available power measuring instruments were compared on the basis of readings made in front of an oven operated with the door open. Author (USGRDR)

N70-13046# California Univ., Livermore. Lawrence Radiation Lab.
A NEW APPARATUS TO SHEAR BULK MATERIALS AT VARIOUS STRAIN RATES UNDER VERY HIGH PRESSURE
A. E. Abey and H. D. Stromberg 24 Jul. 1969 10 p Presented at the ASME Winter Annual Meeting, Los Angeles, 16–20 Nov. 1969 Sponsored by AEC
(PB-186099; UCRL-71875) Avail: CFSTI CSCL 13I

An apparatus is described which will shear bulk materials at various strain rates while the materials are under nearly hydrostatic pressures. This apparatus gives complete stress-strain curves in the plastic region at pressures from about 10 kbar to approximately 80 kbar. Data on beryllium are given as an example of the type of data available from this apparatus. Author (USGRDR)

N70-13075*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
A FORCE BALANCE SYSTEM FOR THE MEASUREMENT OF SKIN FRICTION DRAG FORCE IN THE PRESENCE OF LARGE VIBRATIONS AND TEMPERATURES
Eugene S. Mc Vey and James W. Moore Sep. 1969 239 p refs
(Grant NGR-47-005-026)
(NASA-CR-107134; EME-4029-109-69U) Avail: CFSTI

CONTENTS:

1. A FORCE BALANCE SYSTEM FOR THE MEASUREMENT OF SKIN FRICTION DRAG FORCE IN THE PRESENCE OF LARGE VIBRATIONS AND TEMPERATURES E. S. Mc Vey and J. W. Moore 75 p (See N70-13076 03-15)
2. DESIGN AND EVALUATION OF A GAS BEARING SUPPORT FOR A SKIN FRICTION METER A. Ludwig Schilbe, Jr. 71 p refs (See N70-13077 03-15)
3. THE CONTERBALANCING OF ACCELERATIONS IN A SKIN FRICTION METER R. G. Ashby 88 p refs (See N70-13078 03-14)

N70-13076*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
A FORCE BALANCE SYSTEM FOR THE MEASUREMENT OF SKIN FRICTION DRAG FORCE IN THE PRESENCE OF LARGE VIBRATIONS AND TEMPERATURES
Eugene S. Mc Vey and James W. Moore *In its* A Force Balance System for the Meas. of Skin Friction Drag Force in the Presence of Large Vibrations and Temp. Sep. 1969 p 1–73 (See N70-13075 01-15)
Avail: CFSTI CSCL 13G

Evaluated are the following three force balance mechanisms with feedback for their application to skin friction measurements at wide temperature ranges: (1) an electrical system which uses a motor-sensor assembly employing cobalt magnetic material; (2) a similar electrical system with coils wound on ceramics; and (3) a fluidic system. The cobalt motor-sensor approach is discarded due to technical limitations. Theoretical aspects of the ceramic coil air-core system are outlined with emphasis on gas bearings and counterbalancing in a later chapter. Work on the fluidic system is summarized. Based on high temperature experimental results and theoretical research, development of a fluidic skin-friction meter which will work in temperatures to 2000 F seems feasible. G.G.

N70-13077*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
DESIGN AND EVALUATION OF A GAS BEARING SUPPORT FOR A SKIN FRICTION METER
Andrew Ludwig Schilbe, Jr. *In its* A Force Balance System for the Meas. of Skin Friction Drag Force in the Presence of Large Vibrations and Temp. Sep. 1969 71 p refs (See N70-13075 03-15)
Avail: CFSTI CSCL 13I

A gas bearing support system for a skin friction meter to operate in an extreme temperature environment is presented. Restrictor fed hemispherical bearings with three symmetrically located pads are employed for support of the moving elements of the meter. An experimental investigation was performed to determine the static stiffness of the gas bearing system. The influence of temperature on the stiffness and load carrying capacity of the bearing was determined experimentally. The entire system was successfully tested at ambient temperatures up to 2000 F. Finally, recommended design changes to increase the stiffness, based on the experimental analysis, are suggested. Author

N70-13173# Road Research Lab., Crowthorne (England).
THE EFFECT OF ROAD SURFACE TEXTURE ON TYRE WEAR

R. W. Lowne 1969 25 p refs
(PB-186180; RRL-LR265) Avail: CFSTI CSCL 13F

Most research on tire wear has been carried out to determine the relative wear properties of different tread compounds and carcase constructions. This report describes tests which have been carried out to assess the effect of road surface characteristics on tire wear. The work was prompted by the current trend towards harsher and rougher surfaces for improving wet road skidding resistance. Increase in roughness of the surfaces was found to have a relatively small effect on wear, the major factor being surface harshness. Author (USGRDR)

N70-13245# Mechanical Technology, Inc., Latham, N.Y.
EXPERIMENTAL INVESTIGATION OF A STEAM-LUBRICATED ROTOR-BEARING SYSTEM: STEAM HAMMER INSTABILITY, DOUBLE-ACTING THRUST BEARING, AND SYSTEM DYNAMIC PERFORMANCE
S. B. Malanoski and F. K. Orcutt Jun. 1969 91 p refs
(Contract AT(30-1)-3839)
(NYO-3839-6; MTI-69-TR-29) Avail: CFSTI

A continuing investigation aimed at developing design data for the introduction of steam-lubricated bearings into turbomachines is described. The multi-bearing steam-lubricated apparatus includes journal and thrust bearings with auxiliary systems and instrumentation to control the steam supply rates, the rotor-bearing system dynamic performance, and the environmental temperature. Steam hammer stability tests showed that a double-acting thrust bearing was not only more stable than a single-acting thrust bearing, but also that, by using the double acting thrust bearing in the bearing system, the journal bearing showed improved stability characteristics. Environmental temperature had only a slight effect on the steam hammer stability characteristics. Bearing performance was, however, very sensitive to surface conditions in the region of the steam feed hole. Further study aimed at eliminating this sensitivity is recommended. NSA

N70-13475# National Bureau of Standards, Washington, D.C. Office of Vehicle Systems Research.
SOME PROBLEMS IN MEASURING TREAD WEAR OF TIRES
S. Spinner and F. W. Barton Aug. 1969 29 p refs
(NBS-TN-486) Avail: SOD $0.35

Some problems in tread wear testing of tires are discussed and methods for dealing with these problems are presented. Experimental data are shown to illustrate these methods. Finally some recommendations are made, based primarily on this information, in order to achieve greater uniformity and a statistically valid approach to tread wear testing. Author

N70-13549# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
WELDABILITY OF OXYGEN-FREE, BORON-DEOXIDIZED AND DEOXIDIZED LOW PHOSPHORUS COPPER
Eldon D. Brandon 15 Aug. 1969 13 p ref
(Contract AT(29-1)-1106)
(RFP-1106) Avail: CFSTI

In pressurized gas tungsten arc welding, the variables were chamber pressure, number of welding passes, and type of shielding gas. In the second process, electron beam welding, only the number of passes were varied. When welded under identical conditions, welds in the boron-deoxidized (Alloy 109) copper contained less porosity. The material was, therefore, considered more weldable. Four passes were optimum for the boron-deoxidized (BD) copper while the soundness continued to improve with up to five passes for the oxygen-free (OF) and deoxidized low phosphorus (DLP) copper. Argon and helium shielding gases were evaluated for their ability to produce sound welds. For OF copper, helium was the preferred gas. For BD copper at chamber pressures of 20 pounds per square inch gage and below, argon was preferred. For DLP copper, the gases produced approximately equivalent welds. Chamber pressure was a less significant variable. With OF copper, the weldability increased with chamber pressure. Chamber pressure was not significant with either BD or DLP copper. Author (NSA)

N70-13566*# Sandia Corp., Albuquerque, N.Mex.
CONTAMINATION CONTROL HANDBOOK
Washington NASA 1969 314 p refs
(NASA Order H-13245A)
(NASA-CR-61264; NASA-SP-5076) Avail: CFSTI CSCL 13H

Technical information and data on contamination control are assembled and include the following topics: contamination control in product design, gases, and liquids; and microbial, airborne, and surface contamination control. Sections are also presented on radiation, clean packaging, and maintaining product and personnel cleanliness. The experience described was gained in the aerospace community, and is presented as a technology which can be utilized in pharmaceutical, electronic, and other industries. B.P.

N70-13919# Sandia Corp., Livermore, Calif.
BIAXIAL TENSILE TESTER FOR FLAT PLATES
K. Sakaguchi et al Aug. 1969 17 p refs Transl. into ENGLISH from J. of the Soc. of Mat. Sci. (Japan), v. 17, no. 175, Apr. 1968 p 356–360
(PB-186205T; SCL-T-69-254) Avail: CFSTI CSCL 14B

A new type of biaxial tensile tester for flat plates has been developed, which can produce uniform extension of a square plate in two perpendicular directions. The tensile mechanism of this tester consists of two servomechanisms for controlling the position of the two traveling beams on which clamp chucks are mounted. These chucks are capable of smooth movement on the beam surface by means of ball bearings. Using this tester it is possible to perform tensile testing, stress relaxation measurements, creep testing, and fracture strength testing, under homogeneous biaxial stress. In this paper the mechanism of this tester is described, and the results of elastic property measurements of rubber sheets using this tester are reported. Author (USGRDR)

N70-13961# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
INDEX OF ASTME TECHNICAL PAPERS ON MACHINING AND DIMENSIONAL MEASUREMENT
7 Oct. 1969 89 p refs Supersedes Y-DM-5
(PB-186203; Y-DM-5-REV-1) Avail: CFSTI CSCL 13H

A permuted-title index has been prepared of selected technical papers published during the five-year period from January 1964 through December 1968 by the American Society of Tool and Manufacturing Engineers (ASTME) on the subjects of machining and dimensional measurement. The index consists of three major sections: (1) a permuted-title subject index, (2) a personal author index, and (3) a bibliographic section. The bibliographic section is arranged chronologically according to the year of publication and includes a title, personal author, corporate author, and ASTME paper number for each technical paper referenced. Author (USGRDR)

N70-13969# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRAIN HARDENING OF PARTS AT HIGH TEMPERATURES UNDER ASYMMETRIC LOADS
G. Z. Zaitsev et al 22 May 1969 15 p refs Transl. into ENGLISH from Mashinovedeniye (USSR), no. 4, 1967 p 80–85
(AD-694401; FTD-MT-24-435-68) Avail: CFSTI CSCL 13/8

Results are presented of an investigation of the effectiveness of surface strain hardening to increase the fatigue strength of turbine-blade roots at high temperatures under asymmetric loads. The following data on thermal treatment of samples are given: (a) EI726 steel-austentizing, 1140-1160 degrees; air-cooling and aging, 750 degrees for 25 hrs; (b) EI481 steel-hardening, 1050-1100 degrees, 1 hr plus 1140-1150 degrees, 1 hr 30 min. of water quenching; aging, 670 degrees, 12 hr plus 790 degrees and 12 hrs of air-cooling. The investigation was begun by selecting strain-hardening regimes, and then the strain-hardening levels of the above-mentioned investigated steels were determined. The effectiveness of the strain-hardening treatment was checked by comparative fatigue tests using a YABM machine. Tests were carried

out under symmetric cyclic loads at room and operating (500 degrees) temperatures. The experiments are described and a table is presented giving the chemical compositions above steels. The experimental results were verified by using them to calculate a real blade root of the GT-700-5 NZL turbine. Author (TAB)

N70-13974# Fabric Research Labs., Inc., Dedham, Mass.
PHENOMENOLOGICAL RESEARCH ON FAILURE MECHANISMS OF CORD REINFORCED RUBBER SYSTEMS, PHASE 1 Interim Report
G. A. M. Butterworth, M. M. Platt, R. E. Erlandson, S. D. Hoenshell, and L. Barish 1 Oct. 1968 74 p refs Prepared for NBS
(Contract FH-11-6090)
(PB-185107; HS-800-173) Avail: CFSTI CSCL 13F

The report contains preliminary information which describes the degradation of cord reinforced rubber test systems during idealized in tire strain cycling. The ultimate objective is to describe the origin and propagation rate of cord in rubber degradation for test systems which experience the high strain rate loading, strain cycles and temperatures encountered in normal and abusive tire use. Two disc compression testers are being used to subject cord in rubber test systems to constant amplitude and frequency strain cycles at predetermined temperatures and averaged strain rates. Both inherent property and also geometrical changes are being noted and changes in fiber and hence cord stress-strain properties are being measured. Author (USGRDR)

N70-13990 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF THE WELDING IN DILATATION JOINTS DESTINED TO CHOPIM HYDROELECTRIC POWER PLANT [INSPECAO ULTRA-SONICA DAS SOLDAGENS DAS JUNTAS DE DILATACAO DESTINADAS A USINA DE CHOPIM-ELETROCAP] Technical Note
H. Onusic, M. F. Barbosa, and E. J. Cury 16 May 1969 7 p In SPANISH
(TN-6905.374) Avail: CFSTI

The report describes the inspected parts, the types of weldings, the procedure, equipment, and accessories utilized in the ultrasonic inspection of welds. The results are presented in schematic drawings indicating defect positioning, including echograms of the observed defects. Author

N70-14050# Oxford Univ. (England). Engineering Lab.
ON-LINE POSITION CONTROL
R. E. Emmerson and O. L. R. Jacobs Nov. 1969 13 p ref
(Rept-109269) Avail: CFSTI

This report describes a computer controlled mechanical 'arm', built as a demonstration of a new type of digital control where an on-line computer fires thyristors controlling power. The circuitry and software required for efficient computer use are described and future possibilities are discussed. Author (ESRO)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-12708*# Techtran Corp., Glen Burnie, Md.
CERTAIN CHARACTERISTICS OF THE USE OF LASER SPECTRA IN A MONOPULSED SYSTEM FOR ANALYSIS [O NEKOTORYKH OSOBENNOSTYAKH PRIMENENIYA SPEKTROV OPTICHESKOGO K VANTOVOGO b MONOIMPULSNOM REZHME DLVA ANALITICHESKIKH TSELEV]
V. I. Kasatkin et al Washington NASA Nov. 1969 6 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. 8, no. 2, 1968 p 223–226
(Contract NASw-1695)
(NASA-TT-F-12696) Avail: CFSTI CSCL 20E

Experiments were conducted involving exposure of specimens to high energy laser radiation in the monopulse mode and in groups of 2 or 3 pulses. Photographs of the resultant flame plus spectra of the emission indicated that the monopulse mode results in clear spectra with reduced background emission in comparison to 2- or3-pulse excitation. The possibilities for analysis are noted. Author

N70-12767*# Techtran Corp., Glen Burnie, Md.
POSSIBILITIES FOR USING LASERS IN THE MONOPULSE MODE FOR SPECTRAL ANALYSIS [O VOZMOZHNOSTI PRIMENIYYA OPTICHESKIKH KVANTOVKH GENERATOROV MONOIMPULSNOM REZHIME DLYA SPEKTRALNOGO ANALIZA]
V. V. Panteleyev et al Washington NASA Nov. 1969 6 p refs Transl. into ENGLISH from Zh. Prik. Spektroskoppi, Akad. Nauk Belorussk. SSR (USSR), v. 8, no. 6, 1968 p 905–908
(Contract NASw-1695)
(NASA-TT-F-12697) Avail: CFSTI CSCL 20E

The characteristics of monopulsed laser excitation of spectra of metals are described. Monopulsed laser excitation results in extremely low material consumption, plus the production of highly excited spectra. Ionic line forms predominate over atomic forms. A calibration graph for the determination of zinc is presented, although the method is not highly accurate from the quantitative standpoint. Author

N70-12889# California Univ., Livermore. Lawrence Radiation Lab.
THE CALCULATION OF ULTRASHORT PULSE PHENOMENA IN LASERS
J. A. Fleck, Jr. 9 Sep. 1969 23 p refs Submitted for publication Sponsored by AEC
(PB-186347; UCRL-71931) Avail: CFSTI CSCL 20E

The emission of laser radiation as a succession of pulses, under various conditions, has been a familar phenomenon for some time. Here we describe a detailed theoretical model of short pulse emission by lasers, and apply it, by solving the model equations numerically, to the generation of short pulses by a Q-switched laser operating both with and without a saturable absorber in the cavity. In applying the model, an attempt is made to follow the details of emission from initiation by spontaneous emission through nonlinear amplification and the depletion of gain. Author (USGRDR)

N70-13368# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
THERMALLY INDUCED INTERFERENCE PATTERNS IN LIQUIDS Final Report
Seymour S. Alpert 1 Aug. 1969 20 p Sponsored by Sandia Corp.
(PB-185135; SC-CR-69-3199) Avail: CFSTI CSCL 20F

A study was initiated to determine the nature and consequences of the light induced thermal effects in liquids. Many observations were made of thermal-light phenomena. The most striking of these phenomena was the 'blooming' of the original laser light beam into a complex ringed structure on passing through an energy absorbing liquid. In order to make quantitatively reliable measurements of the size and angular divergence of laser light going into the 'bloom' it was necessary to devote a major output of time and energy into the development of techniques designed to obviate problems of noise and instability relating to the optical interference pattern. USGRDR

N70-13688# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF FACTORS INFLUENCING THE CHARACTER OF THE SPECTRUM OF A LASER-INDUCED PLASMA
A. I. Korunchikov et al 7 May 1969 12 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. 7, no. 4, 1967 p 564–568
(AD-693832; FTD-HT-23-1359-68) Avail: CFSTI CSCL 14/2

This is a continuation of earlier work dealing with the plasma flare produced when a laser beam is focused on a substance, and particularly with the effect of the laser energy, the beam focusing, the pressure of the atmosphere surrounding the investigated sample, and the properties of the sample itself on the character of the plasma. The present article is devoted to the influence of the same effects on the spectral characteristics of the plasma. The tests were made by focusing the emission of a GSI-1 laser, operating in the free-running mode on the surface of metallic samples. The variation of the intensity along the plasma flare was determined by projecting the image of the flare on the slit of an ISP-22 spectrograph. At atmospheric pressure, the intensities of the spectral lines increased rapidly with increasing distance between the plasma flare and the surface of the sample, reaching a maximum at distances that depended on the excitation energy. TAB

N70-13784# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPLOSION IN A LIQUID CAUSED BY LASER FOCUSING AND RADIATION
V. S. Teslenko 7 May 1969 5 p Transl. into ENGLISH from Abstr. Student Sci. Conf. at Novosibirsk State Univ., 1967 p 11–12
(AD-693843; FTD-HT-23-07-69) Avail: CFSTI CSCL 20/5

The results of experimental observation of the dynamic explosive process obtained by focusing a ruby laser beam into water are presented. The development of the vapor-gas cavity and the shock-acoustic waves are described as obtained by the shadow and half-shadow method with the aid of highspeed photography. The shock waves were at the same time recorded piezoelectrically. Author (TAB)

N70-13811# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
INFLUENCE OF SERIES RESISTANCE ON GaAs LASER POWER OUTPUT AND HEAT LOSSES
Kenneth L. Klohn and Lothar Wandinger Aug. 1969 20 p refs
(AD-694366; ECOM-3161) Avail: CFSTI CSCL 20/5

A theoretical thermodynamic study was made of a typical CW laser diode structure, at cryogenic temperature, to determine the influence of series resistance (with emphasis on contact resistance) on the power output, power efficiency and power heat losses. The heat losses are due to threshold power, an internal quantum efficiency less than one, reabsorption of coherent light by free carriers and ohmic heating. It was shown that the incorporation of a high surface impurity concentration on both the n- and p-sides of a laser diode leads to a substantial reduction in the contact resistance and subsequently series resistance, thereby resulting in a significant improvement in power output and power efficiency. Author (TAB)

N70-13856# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Lab.
EFFECT OF ELECTRON TEMPERATURE ON CARBON DIOXIDE LASER LEVEL POPULATION RATES
Charles Cason 16 Jun. 1969 9 p refs
(AD-693784; RR-TR-69-11) Avail: CFSTI CSCL 20/5

Estimates of the population rate of carbon dioxide and nitrogen vibration levels have been made as a function of electron temperature using Schulzs and Boness cross section data. The population rate for carbon dioxide is greater than that of nitrogen for an electron temperature of 0.4 to 8 electron volts, peaking at about 0.9 electron volts. Author (TAB)

N70-13892# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROGER EARTH, OVER
G. Pokrovskii 17 Mar. 1969 7 p Transl. into ENGLISH from Tech. Molodezhi (Moscow), v. 35, no. 11, 1967 p 37–38
(AD-693939; FTD-HT-23-1237-68) Avail: CFSTI CSCL 17/2

The author asserts that eventually scientists with the aid of a laser will be successful in their attempts to transmit energy in the form of a light beam from the earth to the moon. He states that besides energy and information, this same conveyer could be used to transmit other matter, such as fuel, air, and metals, thereby partially solving one of the major problems of delivering essential goods to the moon and possibly to other planets at a minimum cost. He suggests a hollow laser beam, which could be achieved with the use of light conductors or a hollow ruby rod. Such pipelines could reach through space from one planet to another carrying information, energy, and matter. TAB

N70-13954# Texas Univ., Austin. Antennas and Propagation Lab.
THEORETICAL AND EXPERIMENTAL STUDY OF THE SPATIAL COHERENCE OF LASER RADIATION AND ITS APPLIATION TO UNDERWATER DETECTION SYSTEMS
S. G. Varnado and A. H. La Grone 18 Jul. 1969 192 p refs
(Grant NSF GZ-974)
(PB-185213; P-36) Avail: CFSTI CSCL 17H

Intensity patterns in the field of quasi-monochromatic sources have been computed for sources having Gaussian intensity distributions and Gaussian spatial coherence distributions across the source. The beam-broadening and reduction in on-axis intensity have been expressed in terms of the coherence function of the source. The second-order statistics of the radiated field, as represented by the normalized degree of coherence, are presented. A brief discussion of the coherence relationship as a function of distance through natural media is presented. Experimental results are also presented of the measurements of the spatial coherence of laser radiation after propagation through water. The signal-to-noise ratio for an underwater optical heterodyne detection system is derived. Author (USGRDR)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-12714# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DEVELOPMENT AND FABRICATION OF REFRACTORY METAL MICROBALLOONS
K. R. Sump Jun. 1969 15 p
(Contract AT(45-1)-1830)
(BNWL-1100) Avail: CFSTI

The deposition of refractory metals upon expendable microspherical substrate to form thin-walled refractory metal microballoons was successfully demonstrated. Both tungsten and rhenium were deposited upon these spherical cores by the process of chemical vapor deposition. The substrate was removed by heating in a vacuum environment to leave the refactory metal microballoons. Author (NSA)

N70-12717# Argonne National Lab., Ill. Metallurgy Div.
ANALYSIS OF MAGNETIC FIELDS IN A METAL
D. L. Waidelich May 1969 20 p refs
(Contract W-31-109-eng-38)
(ANL-7551) Avail: CFSTI

In the nondestructive testing of metals, experimental measurements had shown that the attenuation of electromagnetic waves originating from a masked probe and passing through a thin sheet of metal was much less than that predicted by the use of a mathematical model employing plane waves with the pulsed magnetic vector parallel to the surface of the metal. An analysis was made by assuming that the pulsed magnetic vector was perpendicular to the surface of the metal. The results of both analyses indicated that the attenuation in the metal was the same and was very nearly equal to the attenuation observed experimentally. The plane wave analysis with the magnetic vector parallel to the metal surface, however, would require a large attenuation at the air-to-metal and the metal-to-air boundaries, whereas the analysis with the magnetic vector perpendicular to the metal surface would probably require very little attenuation at these surfaces. Author (NSA)

N70-12772# British Iron and Steel Research Association, London (England). Mechanical Working Div.
THE ELECTRODEPOSITION OF AN ADHERENT COATING ON TO STAINLESS STEEL POWDER
F. W. Salt 1969 6 p
(PB-185929; MW/54/68) Avail: CFSTI CSCL 11F

Ways of electrodepositing a metallic coating on particles of stainless steel powder to facilitate compaction and sintering are discussed. A laboratory apparatus for electrodepositing iron on particles in a fluidized bed is described. The design of a plant for processing 1 tonne lots of powder is outlined. Author (USGRDR)

N70-12773# British Iron and Steel Research Association, London (England). Metallurgy Div.
LINEAR ELASTIC FRACTURE MECHANICS IN THE UNITED KINGDOM. WORK OF THE BISRA FRACTURE TOUGHNESS (HIGH STRENGTH STEELS) COMMITTEE
C. L. M. Cottrell and M. J. May 1969 10 p refs Prepared in cooperation with Bristol Aerojet, Ltd.
(PB-185931; MG/E/160/69) Avail: CFSTI CSCL 11F

A study was made of test methods for high strength steels. The aim was to improve the uniformity of testing, particularly in the measurement of properties on which data were lacking, e.g. transverse properties and notch sensitivity, with the intention of providing data to assist designers in the choice of steel for critical application. USGRDR

N70-12774# British Iron and Steel Research Association, London (England). Metallurgy Div.
THE MECHANICAL PROPERTIES OF CONTROLLED ROLLED NIOBIUM SILICON STEELS
D. Burton and A. B. Rothwell 1968 14 p refs
(PB-185935; MG/C/47/68) Avail: CFSTI CSCL 11F

The effect of silicon on the mechanical properties of niobium-containing steels was shown to be less consistent than in plain carbon manganese steels. There was an interaction between niobium and silicon which resulted in a decrease in the effect of silicon on yield strength as niobium was increased. The variation in properties which was observed was well accounted for by regression equations based on chemical and process variables, though the standard deviation was rather high in the case of the impact transition temperature. The results indicate that in controlled rolled niobium steels, up to 0.5 wt % silicon could profitably be added, resulting in improvements in yield strength, tensile strength, and impact transition temperature. Author (USGRDR)

N70-12775# British Iron and Steel Research Association, London (England). Metallurgy Div.
THE APPLICATION OF TIME-TEMPERATURE PARAMETERS FOR THE PREDICTION OF LONG TERM ELEVATED TEMPERATURE PROPERTIES USING COMPUTERISED TECHNIQUES
R. P. Harvey and M. J. May 1969 23 p refs
(PB-185930; MG/Q/183/69) Avail: CFSTI CSCL 20L

A computer based system for the processing of large amounts of creep rupture data is briefly described. The practical problems encountered in attempting to provide accurate creep rupture strength values for material specifications are considered, with particular reference to the selection and application of time temperature parameters for extrapolation. Experience with the use of a computer method for optimization of the constants of the generalized equation of Manson and its application to different steels and conditions of test data, are described. The influence of testing error, and metallurgical features on scatter and extrapolation difficulties are considered and preliminary results of a statistical survey of prediction accuracies are presented. Author (USGRDR)

N70-12784# California Univ., Berkeley. Lawrence Radiation Lab.
FRACTURE TOUGHNESS OF PRECIPITATION HARDENING ALUMINUM ALLOYS
David Eugene Porter (Ph.D. Thesis) Apr. 1969 141 p refs
(Contract W-7405-eng-48)
(UCRL-19004) Avail: CFSTI

The mechanical properties of five high purity aluminum-zinc alloys (7 to 50% Zn) and four high purity aluminum-silver alloys (5 to 30% Ag) were investigated. Emphasis was placed on inter-granular fracture. The properties were correlated with the micro-structure and fractographic observations. There were two basic intergranular fracture processes, a slow and a fast-crack growth process. Slow-crack growth occurred by microvoid coalescence, leaving a dull fracture surface. Fast-crack growth leaves a bright featureless surface. Of the alloys studied, only the aluminum-zinc alloys with 25% zinc or more in the maximum strength condition were found to fracture by a fast-crack growth process. Fast-crack growth was generally preceded by slow-crack growth. The latter process took place at lower stress intensity levels and if allowed to continue under a constant load it would lead to failure. Crack growth would continue under a constant load that was sufficient for initiation of the process as there was no mechanism to blunt the crack. Author (NSA)

N70-12799# Arizona Univ., Tucson. Dep. of Physics.
IMPURITY DIFFUSION IN SOLIDS Technical Progress Report, 1 Dec. 1968 - 30 Nov. 1969
C. T. Tomizuka 1969 7 p refs
(Contract AT(11-1)-1041)
(PB-186058; COO-1041-013) Avail: CFSTI CSCL 20L

Our major efforts were directed toward diffusion measurements in metals and alloys at high pressures. Activation volume of this process has been established experimentally for Cu, Zn, In and Au - Ag alloys. The improved furnace design gave more reliable results than those obtained previously. It was discovered that the self-diffusion rates which appear in literature for bismuth is in error by a large factor. The course of this earlier error by others is most likely the near-surface effect discovered in this laboratory. Author (USGRDR)

N70-12883# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
STRESS-STRAIN BEHAVIOR OF SEVERAL STAINLESS STEELS TO ELEVATED TEMPERATURES
J. B. Conway, J. T. Berling, R. H. Stentz, and D. G. Selyards May 1969 268 p refs
(Contract AT(40-1)-2847)
(GEMP-686) Avail: CFSTI

Results of measurements of the low cycle fatigue characteristics of AISI 304, 316, and 348 stainless steels at 430

to 816 C are presented. Particular attention was directed toward the relations between low cycle fatigue behavior, short term tensile properties, and prediction of low cycle fatigue in a material based on knowledge of its short term tensile properties. Author (NSA)

N70-12894# General Electric Co., Sunnyvale, Calif.
SODIUM COMPONENTS DEVELOPMENT PROGRAM MASS TRANSFER INVESTIGATIONS IN LIQUID METAL SYSTEMS. Quarterly Progress Report, Dec. 1968 – Feb. 1969
Apr. 1969 45 p refs
(Contract AT(04-3)-189)
(GEAP-10008; QPR-8) Avail: CFSTI

Studies involving steel exposed to Na revealed that corrosion rates were found to be weakly dependent on mass flow at 1300 F, approximately 2,000 hours, and 3 ft/sec velocity. Saturation of iron in the sodium was established by negligible weight losses of ARMCO iron samples. The effect of heat-flux on corrosion was further investigated. An electron-bombardment (EB) heater was operated continuously in loop 9 for 1250 hours at about 172 watts/ sq cm heat flux with 1300 F bulk sodium outlet. Particulates causing plugging of the orifices at low temperature were identified as sodium hydride and sodium hydroxide. Less than 1 ppM of cyanide was found in samples removed at temperatures from 755 to 1230 F (solubility of CN is >100 ppM at 1100 F). After a carbide agglomeration heat treatment, a 100% increase in time-to-rupture was found compared with mill annealed material. A 10,000-hour stress-rupture run was started in loop 4R at 1300 F involving annealed and carbide agglomerated specimens of types 304 and 316 stainless steel. Author (NSA)

N70-12902# British Steel Corp., London (England). Midland Group.
ELLIOTT 803 STATISTICAL PROGRAMS. PART 7: OPTIMIZATION OF PARAMETERS IN EXPONENTIAL TYPE CURVES (PRS 18)
R. Middleton 1969 5 p
(PB-186297; PZ.004/S.5217/8/C-Pt-7) Avail: CFSTI CSCL 11F

The program described in the report is one of a series of general statistical programs. It has been specifically written to aid the statistician in analysing data collected from Jominy end-quench hardenability experiments. The program optimizes the parameters of two exponential type curves by the Newton Raphson iterative method. The hardenability curves of many steels fall into a family of curves that have been shown to resemble the shape of the exponential type curves included in this program. The operating instructions together with details concerning the preparation of steering and data are also given in the report. Author (USGRDR)

N70-12915# Union Carbide Corp., Oak Ridge, Tenn.
ROLLING AND RECRYSTALLIZATION OF BERYLLIUM SINGLE CRYSTALS
W. J. Hulsey (Ph.D. Thesis—Tennessee Univ.) 18 Aug. 1969 228 p refs
(Contract W-7405-eng-26)
(Y-1679) Avail: CFSTI

The mechanisms of texture development and the relationships between deformation modes and recrystallization behavior in beryllium were investigated. Beryllium single crystals with six different initial orientations were rolled at 500 C. X-ray measurements of the deformation textures were correlated with polarized light measurements of metallographic samples to examine the deformation modes and identify the deformation features of the microstructures. This mechanism moved basal poles from the rolling direction and to a lesser extent from the transverse direction to the vicinity of the rolling plane normal. A relatively stable end orientation was found with basal poles forty degrees from the rolling plane normal toward the transverse direction. Two new microstructural effects were noted in crystals oriented for compression along the c axis. Author (NSA)

N70-12943# British Steel Corp., London (England). Mechanical Working Div.
THIN STEEL STRIP FROM POWDER
I. Davies, W. M. Gibbon, and A. G. Harris 1969 13 p refs Presented at the Ann. Meeting Powder Met. Joint Group of the I.S.I. and Inst. of Metals, 13 – 15 Nov. 1968
(PB-186179; MW/HB/38/68) Avail: CFSTI CSCL 11F

A process for rolling thin strip is described which overcomes the disadvantages normally associated with powder rolling. Strip samples were made from both iron and stainless steel powders and an experimental plant has been built for continuous strip production. An economic assessment of the manufacture of mild steel and stainless steel strip by the powder route shows possible cost savings when compared with existing production methods. Author (USGRDR)

N70-12961# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMAL CONDUCTIVITY OF AEROSPACE ALLOYS AT CRYOGENIC TEMPERATURES
J. G. Hust and Robert L. Powell 1968 12 p refs Presented at the Conf. on Thermal Conductivity, Lafayette, Ind., 7 – 10 Oct. 1968
(PB-186355; R-515) Avail: CFSTI CSCL 11F

Thermal conductivity, electrical resistivity, Lorenz ratio, and thermopower was determined for several aerospace alloys between 4 and 300K: titanium A-110 AT, Inconel 718, Hastelloy X, and aluminum 7039. These data are presented graphically. By utilizing detailed numerical and theoretical analyses, it was possible to separate the electronic and lattice contributions to the total thermal conductivity. Various scattering mechanisms were resolved for both types of conduction. The first three alloys are predominately lattice conductors at low temperatures, with total Lorenz numbers as high as 15 sq V/K sq near 20 K. Author (USGRDR)

N70-12962# British Steel Corp., London (England). Steelmaking Div.
NUMERICAL RESULTS FROM EXERCISES CARRIED OUT BY THE GROUP TO EVALUATE THE OPERATOR ERRORS THAT OCCUR IN THE ASSESSMENT OF NON-METALLIC INCLUSIONS BY CONVENTIONAL METALLOGRAPHIC METHODS
1969 21 p
(PB-186177; SM/BE/110/67-Add) Avail: CFSTI CSCL 11F

The document is an addendum giving the full results of the co-operative exercises carried out by optical microscopy group and on which the conclusions drawn in a former paper are based. Author (USGRDR)

N70-12977+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION FOR CORROSION CONTROL OF HYDROGEN STEEL CYLINDER TUBULAR DEPOSITS [CONTROLE ULTRA-SONICO DA CORROSAO DE TORPEDOS DE HYDROGENIO]
H. Onusic 19 Aug. 1969 14 p In PORTUGUESE; ENGLISH summary
(TN-6908.380) Avail: CFSTI

The note describes the inspected parts, the procedures, equipment and accessories used for the corrosion control of steel tubular cylinders used for hydrogen storage. The results are presented in schematic form, indicating the thickness observed in the inspected deposits, and photographs of the observed echograms are included. Author

N70-12980# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy.
TRANSFORMATION CHARACTERISTICS OF ZIRCONIUM-NIOBIUM AND OTHER ALLOYS
A. J. Perkins and R. F. Hehemann 31 Jul. 1969 52 p refs
(Contract AT(11-1)-588)
(COO-588-16) Avail: CFSTI

A modulated structure of beta and omega is developed

when Zr – Nb alloys are aged at appropriate temperatures. Both the particle shape and alignment is interpreted in terms of strain energy developed during the transformation. The athermal omega reaction results from an instability in the bcc phase and the diffuse streaking in X-ray and electron diffraction patterns that accompanies this reaction is attributed to diffuse scattering produced by the unstable normal mode. Similar transition states resulting from an inherent lattice instability occur in a number of systems and frequently precede classical martensitic transformations. The Ti – Ni system has been chosen as the prototype for these systems. Transmission microscopy has revealed dislocation arrays that develop in the transition state and apparently eventually evolve into interfaces involved in the martensitic transformation.
Author (NSA)

N70-12999# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
EFFECT OF IRON ON FISSURING OF URANIUM WELD METAL
P. W. Turner 11 Aug. 1969 268 p refs
(Contract W-7405-eng-26)
(Y-1678) Avail: CFSTI

An arc-spot Varestraint test device was built and utilized for determining the susceptibility of laboratory scale specimens to hot cracking. The specimens were prepared by doping electron beam welds with iron in calculated amounts. Iron compositions ranged from nominally 50 ppM to 7,700 ppM. The intermediate iron alloys were the most sensitive to hot cracking. Weld metal with iron contents at the upper and lower ends of the range of compositions were resistant to hot cracking. Welds containing less than 600 ppM iron were not prone to hot cracking at any of the strain levels studied. Weld metal with less than 900 ppM iron did not crack at strain levels normally encountered in weldments. Metallography, fractography, and electron microprobe analysis results indicated that cracking was caused by a liquid film which persisted on cooling to form U6Fe and possibly Fe2 along grain and solidification subgrain boundaries of the primary phase. Correlation of results of the Varestraint test with those of weld tests revealed that hot cracking was dependent on the welding conditions as well as on iron composition.
Author (NSA)

N70-13004# British Steel Corp., London (England). Mechanical Working Div.
THE PRODUCTION OF STAINLESS STEEL STRIP FROM POWDER
G. M. Sturgeon, G. Jackson, V. Barker, and G. M. H. Stykes 1969 11 p refs Presented at the Ann. Meeting Powder Met. Joint Group of the I.S.I. and Inst. of Metals, 13 – 15 Nov. 1968
(PB-186175; MW/HC/37/68) Avail: CFSTI CSCL 11F

Production methods for stainless steel strip, initially in the size range 0.080 – 0.010 in. were examined. The production of Type-304L strip direct from water atomized powder without the addition of bonding agents is described. The production cycle for powder rolled strip consists of roll compaction using a saturated feed, sintering in line with the compaction mill, conventional cold reduction, and a final annealing treatment. Each stage is discussed, together with the final properties achieved. The main advantages of this production route lie in the elimination of ingot casting and hot rolling and their attendant cleaning and rectification processes. The ability to produce a range of green strip thicknesses enables the amount of deformation to be reduced to that necessary to obtain the desired surface finish and mechanical properties.
Author (USGRDR)

N70-13016# Los Alamos Scientific Lab., N. Mex.
RHENIUM EFFECT IN SINTERED TUNGSTEN-MOLYBDENUM-BASE ALLOYS
W. H. Lenz and R. E. Riley 15 Apr. 1969 19 p refs
(Contract W-7405-eng-36)
(LA-4173-MS) Avail: CFSTI

A brittleness test is described which is useful in quantitatively measuring the limited ductility of sintered tungsten-base alloys. Subsequently, numerous sintered tungsten-molybdenum-rhenium compositions were evaluated to establish alloys which combined room-temperature ductility with a melting point above 2900 C. Ductility trends of the alloys were related to sintering temperature, molybdenum and rhenium content, and ThO2 additive. The fusion temperatures of 18 alloys were determined.
Author (NSA)

N70-13028# National Inst. for Metallurgy, Johannesburg (South Africa).
ACTIVITIES OF THE NATIONAL INSTITUTE FOR METALLURGY FOR 1968 Annual Report
1968 24 p
(NP-17982) Avail: AEC Depository Libraries

A review of 1968 activities is presented. It is noted that inauguration of two university research groups into association with the National Institute during the year is important because of their interest in mineral processing problems. Information is also presented on development of ferrochrome production programs, methods for determining platinum metals, nickel separation methods, evaluation methods for fluorospar, determination of mercury, prospecting for pegmatites, determination of rare earths, and prospecting for phosphates. Research on uranium and thorium compounds is reviewed and development of methods for UF6 production is discussed along with methods for UO2 and Au separation.
NSA

N70-13060*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATISTICAL DESIGN AND ANALYSIS OF OPTIMUM SEEKING EXPERIMENTS TO DEVELOP A GAMMA-PRIME STRENGTHENED COBALT-NICKEL BASE ALLOY
Gary D. Sandrock and Arthur G. Holms Washington Dec. 1969 77 p refs
(NASA-TN-D-5587; E-5023) Avail: CFSTI CSCL 11F

A previously developed Co-base alloy was modified to achieve gamma-prime strengthening by the addition of Ni and Al. The levels of four of the eight elements in the composition were then optimized by the statistically founded Box – Wilson strategy of experimentation. The final as-cast alloy was characterized with regard to mechanical properties, oxidation resistance, and microstructure. The alloy is believed to have potential for aerospace applications.
Author

N70-13063# British Steel Corp., London (England). Scottish and North West Group.
THE WELDABILITY OF SAMPLES OF 1/2 INCH TO 1 INCH THICK COR-TEN B QUALITY STEEL EXCAST NO. F2032
G. Todd 1969 9 p
(PB-186173; SNW(C)W-93/1) Avail: CFSTI CSCL 11F

Manual butt weld, fillet weld and C.T.S. tests on steel samples in the thickness range 1/2 in. to 1 in. thick have shown that Cor-Ten B quality steel can be welded in thickness up to and including 1 in. without preheat, using properly dried hydrogen controlled electrodes and with typical commercial welding conditions.
Author (USGRDR)

N70-13178# Bettis Atomic Power Lab., Pittsburgh, Pa.
DYNAMIC PROPERTIES OF MATERIALS
R. R. Garner May 1969 56 p refs
(Contract AT(11-1)-GEN-14)
(PB-184724; WAPD-TM-753) Avail: CFSTI CSCL 11F

The behavior of materials under dynamic loading conditions has been the subject of many investigations. The literature has been surveyed and the strain rate data for steels compiled. The date, the test methods used by the investigators, and the data reduction techniques used in preparing the data for presentation are discussed. Curves of yield and ultimate strength versus strain rate summarize the data. Best fit and suggested design curves generated after grouping the data into strength categories are presented. A

bibliography pertinent to the general subject is presented in addition to a list of the references from which data were taken. Author (USGRDR)

N70-13246# Mitsubishi Heavy-Industries, Ltd., Tokyo (Japan).
BRITTLE FRACTURE CHARACTERISTICS OF NEW MITSUBISHI BAINITIC STEEL
Kazuhisa Suzuki (Kobe Tech. Inst.) Jun. 1969 13 p refs
(PB-185747; MTB-58) Avail: CFSTI CSCL 11F

The results of Charpy-V notch and press notch impact test, deep notch test for brittle fracture initiation characteristics, ESSO test with temperature gradient for brittle fracture arresting characteristics, NRI, type drop weight test and crack starter explosion test are reported for 2 kinds of MBHT (Mitsubishi bainitic high and ultrahigh tensile steel) of the 100 kg/sq mm class, which can be used for high tensile steel welded structures subject to explosive loading under low temperature circumstances. USGRDR

N70-13262# Oak Ridge National Lab., Tenn.
CONCENTRATION CHANGES IN BINARY METAL-GAS SOLUTIONS DURING SIMULTANEOUS REMOVAL OF GAS AND EVAPORATION OF METAL. PART 2. DISCUSSION OF THE CONCENTRATION CHANGES IN THE SYSTEMS VANADIUM-OXYGEN, NIOBIUM-OXYGEN, TANTALUM-OXYGEN, NIOBIUM-NITROGEN, VANADIUM-NITROGEN, AND TANTALUM-NITROGEN
Hoerz Gerhard [1969] 12 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 60, 1969 p 121–126
(ORNL-TR-2171) Avail: CFSTI

Using thin samples the degassing kinetics in the systems vanadium-oxygen, niobium-oxygen, tantalum-oxygen, niobium-nitrogen, and tantalum-nitrogen were determined and compared with the results of the theoretical treatment of the concentration changes in metal-gas solutions during annealing. It is found, that in the systems niobium-oxygen, tantalum-oxygen, niobium-nitrogen, and tantalum-nitrogen the metal evaporation is negligible during almost the whole degassing process up to the melting temperature. In the system vanadium-oxygen metal evaporation is negligible only during a part of the degassing process. In the systems vanadium-oxygen, niobium-oxygen, tantalum-oxygen, niobium-nitrogen, and tantalum-nitrogen the final gas concentration down to which degassing is theoretically possible is determined by the partial pressures of the residual gases in the vacuum apparatus and not by the metal evaporation. Author (NSA)

N70-13335# Oak Ridge National Lab., Tenn. Isotopes Div.
ELECTRON MICROSCOPE IN SITU ANNEALING STUDY OF VOIDS INDUCED BY IRRADIATION IN ALUMINUM
N. H. Packan and D. N. Braski Aug. 1969 19 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL-TM-2645) Avail: CFSTI

The shrinkage of irradiation induced voids in 8001 aluminum alloy and pure aluminum (Cominco Grade 69) was investigated by annealing thin foil specimens in a high vacuum electron microscope. The general shrinkage characteristics of both materials were quite similar, but the shrinkage curves for individual voids showed considerable variation. Most of the voids exhibited an initial high rate of shrinkage. Both effects may reflect the influence of unresolvable local vacancy sinks. Author (NSA)

N70-13361# Central Mechanical Engineering Research Inst., Durgapur (India).
RESEARCH AND DEVELOPMENT IN ELECTRICAL SHEET STEEL MAKING
R. A. Padmanabhan Mar. 1969 28 p refs
(PB-185705; CMERI-M8) Avail: CFSTI CSCL 11F

This paper traces the history of development of magnetic alloys, particularly Fe-Si for use in power transformers. Besides outlining the commercial methods of production of the electrical sheet steels, the paper describes the physical properties and crystallographic aspects of cold rolled grain oriented silicon steel, particularly directional properties and preferred crystal orientations introduced by the process of cold rolling and annealing. The effect of non-metallic impurities in silicon iron and the effect of metallic additions to advantages are also discussed. Future research trends and developmental possibilities in the field of electrical sheet steels are also indicated. Author (USGRDR)

N70-13398# Illinois Univ., Urbana. Dept. of Physics.
INFLUENCE OF TRACE IMPURITIES ON DEFECT BEHAVIOR
J. S. Koehler 1969 16 p refs Presented at Corrosion by Liquid Metals Conf., Philadelphia, 14 Oct. 1969
(Contract AT(11-1)-1198)
(COO-1198-661; CONF-691007-1) Avail: CFSTI

Experiments which demonstrate that impurities nucleate clusters of interstitials and clusters of vacancies in gold are described. The experiments utilize specimens with total impurity concentration between 0.00001 and 0.000001 atom fraction. It is shown that the impurities influence damage production during electron irradiation at 80 K, alter annealing after quenching and after electron irradiation and influence the apparent activation energy observed in certain quenching and deformation experiments. Author (NSA)

N70-13495*# Hydronautics, Inc., Laurel, Md.
EXPERIMENTAL RESEARCH ON HIGH FREQUENCY FATIGUE AND DYNAMIC TENSILE TESTS AT ELEVATED TEMPERATURES
Andrew F. Conn and A. Thiruvengadam Jul. 1969 76 p refs
(Contract NAS3-11168)
(NASA-CR-72618; TR-829-1) Avail: CFSTI CSCL 11F

The effects of elevated temperature and high strain rate on fatigue life and tensile properties were measured for annealed 316 stainless steel and titanium alloy 6A1-2Mo-4Zr-2Sn in the solution heat treated and aged condition. A 14 KHz magnetostriction oscillator was used for fatigue testing. A split Hopkinson pressure bar provided dynamic tensile data up to 1300 F. The fatigue data were bracketed by Manson fatigue life predictions, based on static and dynamic tensile properties, although the dynamic prediction curves generally agreed better with data from the highest cycle tests. Creep effects were found to be negligible. Author

N70-13506# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
LOW TEMPERATURE TECHNIQUES FOR ELECTRON IRRADIATIONS
C. M. Jimenez, L. F. Lowe, and E. A. Burke Oct. 1968 58 p refs *Its* Instrumentation Papers No. 148
(AD-678102; AFCRL-68-0502) Avail: CFSTI CSCL 11/6

The experimental techniques for low temperature electron irradiation of metals are discussed in detail. Problems discussed include those of dosimetry, temperature measurement, sample preparation and data analysis. Author (TAB)

N70-13507# Michigan Univ., Ann Arbor. Lab. of Cavitation and Multiphase Flow.
CAVITATION EROSION DAMAGE ON HIGH MANGANESE AUSTENITIC STEEL
F. G. Hammitt and C. Chao Sep. 1968 15 p refs Supported by Mich. Mem. Phoenix Proj.
(PB-184745; MMPP-344-2) Avail: CFSTI CSCL 11F

A high manganese, high chromium, medium carbon steel (0.25C, 13Cr, 10Mn) is extremely cavitation resistent. Since this steel is not available in this country, a small lot was induction melted and cast into bars. Tensile test on one of these bars, and cavitation erosion tests were conducted. Author (USGRDR)

N70-13512# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DIE STAMPING OF PARTS FROM LIQUID BRASS ON FRICTION DIES

T. M. Golubev et al 14 May 1969 11 p Transl. into ENGLISH from Tekhnol. l'Organizatsiya Proizvodstva (USSR), No. 1, 1968 p 40–41

(AD-693857; FTD-MT-29-90-69) Avail: CFSTI CSCL 11/6

Manufacture of three different brass objects by liquid brass die stamping techniques is described. The brass was smelted in an induction furnace, and friction die stamps were used at a nominal pressure. Schematics of the three types of die stamps are presented. The quality of the finished product was determined as a function of the die temperature and die lubricating agent. Author (TAB)

N70-13531# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.

STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report, 1 Jan.–31 Mar. 1969

W. E. Ray May 1969 59 p refs

(Contract AT(30-1)-3791)

(WARD-3791-35) Avail: CFSTI

Under Task SSAA-110, program status and plans were thoroughly reviewed and updated for the remainder of the fiscal year. Under Task SSAA-210, tensile tests and biaxial stress-rupture tests continued on air-melted material; low-cycle strain fatigue tests were initiated; optical metallographic characterization of PNL tubing and of 15 to 20% cold-worked tubing was completed and compared with tube lots previously examined. A subtask for determining the effects of the degree of cold working on the weld-ability of Type 316 stainless steel tubing was planned; equipment requirements were identified; facility preparation was initiated; and processing of vacuum-melted material continued. Under Task SSAA-310, samples of air-melted Type 316 stainless steel were micro-characterized. The sensitization studies continued. The sensitized specimens were examined to determine the stability of the matrix alloy, the types of precipitates, and the precipitation kinetics. For comparison, a section of wrought bar of commercial Type 316 stainless steel, solution treated at 2300 F for 1.5 hours, were similarly sensitized and examined. Author (NSA)

N70-13535+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).

UNTRASONIC INSPECTION OF HIGH QUALITY STEEL PLATES AND SHEETS DESTINED TO THE CONSTRUCTION OF CHEMICAL PLANT EQUIPMENT [INSPECAO ULTRA-SONICA DE CHAPAS DE ACO DE ALTA QUALIDADE DESTINADAS A INDUSTRIA QUIMICA]

H. Onusic, L. Delboni, M. F. Barbosa, and M. F. Spinola 31 Jul. 1969 12 p In PORTUGUESE; ENGLISH summary

(TN-6907.378) Avail: CFSTI

The note describes the equipment, accessories, procedures, and the results of the ultrasonic inspection of steel plates and sheets of high quality steel, which were to be used in the construction of chemical equipment. As there are no specifications published by professional societies for this particular application, the sheets were inspected completely. Author

N70-13672# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF PROLONGED HEATING ON THE MECHANICAL PROPERTIES OF SINTERED ALUMINUM POWDER

M. G. Stepanova et al 14 May 1969 14 p refs Transl. into ENGLISH from Aluminievye Splavy (USSR), no. 5, 1968 p 208–217

(AD-693841; FTD-HT-23-1344-68) Avail: CFSTI CSCL 11/6

Mechanical properties of sintered aluminum powder SAP-1 sheets produced by rolled lamination and of SAP-1 and SAP-3 rods that are pressed are studied in connection with the effect of prolonged heating; heating at 250 degrees C for 1000 and 5000 hours results in no influence on properties in short-term elongation. Sensitivity to cracking in impact bending is slightly reduced. Heating of SAP-1 sheets to a temperature above 450 degrees decreases ultimate strength at 20 degrees and increases relative elongation. At 250-500 degrees the strength characteristics undergo no change. Prolonged heating (100-5000 hours) at 250-500 degrees C has no effect on any grades of pressed SAP semifinished products. TAB

N70-13678# British Iron and Steel Research Association, London (England). Metallurgy Div.

CONTROL OF THE AUSTENITE GRAIN SIZE BY SMALL ADDITIONS OF TITANIUM

T. George and J. J. Irani 1968 14 p refs

(PB-185936; MG/C/32/68) Avail: CFSTI CSCL 11F

The work established that very high austenite grain coarsening temperatures (approximately 1200 C) can be obtained in vacuum melted low Ti-high N carbon-manganese steels. It would appear that in the presence of niobium a lower titanium content was necessary to achieve similar results. USGRDR

N70-13677# British Iron and Steel Research Association, London (England). Chemistry Dept.

THE CORROSION OF MILD STEEL BY COLD POTABLE WATERS

J. C. Hudson and K. O. Watkins 1969 19 p refs

(PB-185937; C/28/69) Avail: CFSTI CSCL 11F

The corrosion of mild steel by British potable waters was studied by immersion tests, mainly for one year, in slowly moving water. The waters investigated were selected to represent the four main types: naturally hard, naturally soft, lime-softened, and base-exchange-softened. Author (USGRDR)

N70-13612# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.

EFFECT OF ATMOSPHERES ON THE MECHANICAL PROPERTIES OF CRYSTALS Final Report

George S. Ansell, Thomas T. Hitch, and John B. Hudson 29 Oct. 1968 65 p refs

(Contract AF 49(638)-1508)

(AD-678207; AFOSR-68-2386) Avail: CFSTI CSCL 11/6

Tensile tests were performed on silver, zinc, and aluminum single crystals in ultra high vacuum. The surfaces of silver samples were cleaned and all the samples were annealed using electron bombardment prior to testing. During the easy glide region of tensile deformation the samples were exposed to a wet oxygen or air contaminant atmosphere. Author (TAB)

N70-13613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRESENT STATE-OF-THE-ART AND PROSPECTS FOR APPLICATION OF ELECTRON BEAM MELTING FOR OBTAINING PURE METALS AND IMPROVING THE PROPERTIES OF EXISTING ALLOYS

B. E. Paton et al 8 May 1969 15 p refs Transl. into ENGLISH from Teoriya Formovki. Tr. Soveshch. (Moscow), 1967 p 5–11

(AD-693833; FTD-HT-23-8-69) Avail: CFSTI CSCL 11/6

The present state of metal refining by electron-beam melting is reviewed and examples of research in this field are presented. Among the presently used electron-beam melting systems, the most popular are axial electron-beam guns and radial electron-beam furnaces. The latter, with a capacity of 100-400 kw have been developed. Niobium and tantalum are easily purified of gases and volatile impurities by electron-beam melting. Author (TAB)

N70-13652# Kresge-Hooker Science Library Services, Detroit, Mich.
HIGH-TEMPERATURE OXIDATION OF ZIRCONIUM AND BINARY ZIRCONIUM ALLOYS WITH SMALL CONCENTRATIONS OF ADDITION ELEMENTS
B. De Gelas et al [1969] 56 p refs Transl. into ENGLISH from the French Report Prepared for Bettis Atomic Power Lab.
(WAPD-TRANS-120) Avail: CFSTI

The effects of binary additions of Cu, Cr, Fe, Mo, Al, Nb, and Sn on the oxidation of Zr base alloys at 750 were examined. Stages of oxidation are described as the initial stage governed by a complex kinetic law, a parabolic stage in which the oxidation rate is controlled by the diffusion of oxygen through the oxide layer, and a final stage involving fissure formation and peeling. NSA

N70-13655# Atomic Energy of Canada, Ltd., Chalk River, (Ontario). Metallurgical Engineering Branch.
THE METALLURGICAL EXAMINATION OF A COLD-WORKED ZIRCALOY-2 PRESSURE TUBE IRRADIATED IN THE U-2 LOOP
W. J. Langford Oct. 1969 36 p refs
(AECL-3457) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.00

A cold-worked Zircaloy-2 pressure tube was irradiated in the NRU reactor for 11,000 hours at 280 C under 14,000 psi hoop stress. Maximum integrated neutron dose was 1.2 × 10 to the 21st power n/cm2 (>1 MeV). Examination of the tube showed that its strength, defect tolerance, corrosion rate and hydrogen pickup were consistent with requirements for a pressure tube life of 30 years. Author

N70-13658# Aeronautical Research Labs., Melbourne (Australia). Dept. of Supply.
TENSILE FRACTURE CHARACTERISTICS OF HEAVILY DRAWN CHROMIUM
A. Ball, F. P. Bullen, F.Henderson, and H. L. Wain Mar. 1969 16 p refs
(ARL/MET-75) Avail: CFSTI

Heavily drawn chromium wires were fractured at a variety of temperatures and strain rates. The condition for fracture was that the yield or flow stress exceeded some critical value which depended on the reduction and the test conditions. The increase in the critical value with decreasing temperature or increasing strain rate was consistent with the behaviour of a friction stress, leading to the conclusion that crack-initiation was the critical stage of fracture. Transmission micrographs showed elongated "clean" cells. Both yield and fracture stresses varied approximately linearly. The variation of effective shear stress at fracture with cell diameter was consistent with theories of fracture. Author

N70-13659# Atomic Energy of Canada, Ltd., Chalk River, (Ontario). Solid State Science Branch.
DEFECTS IN QUENCHED ZIRCONIUM
M. L. Swanson, G. R. Piercy, G. V. Kidson, and A. F.Quenneville Sep. 1969 18 p refs
(AECL-3428) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.00

Zirconium wires were quenched from 600 deg–800 C in gaseous or liquid He, using cryogenic pumping to avoid absorption of impurities. The apparent concentration of defects which were retained in 0.015 cm diameter wires by quenching from 700 C was 0.0001, which was much larger than the expected thermal equilibrium defect concentration. The data indicate that this effect could be caused partly by quenching strains and partly by redissolution of impurities. The quenched-in resistivity increments of 0.035 cm diameter wires were much larger than those of thinner wires. Addition of as much as 5 at. percent O did not appreciably affect the results. The quenched-in resistivity increments annealed out near 400 C. Author

N70-13676# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT CERTAIN BEHAVIORAL PATTERNS OF THERMAL FATIGUE
V. I. Egorov 20 May 1969 15 p refs Transl. into ENGLISH from Tr. Obshchie Probl. Mashinostro. (Moscow), 1967 p 65–72 Presented at Conf. of Young Scientist, Moscow, 1964
(AD-693854; FTD-MT-24-01-69) Avail: CFSTI CSCL 13/7

The startup, shutdown and load-adjustment of various types of power generating equipment often involve thermal stresses and deformations induced by the attendant restriction of temperature-induced expansion. The repeated action of thermal stresses causes cracking and fracture of the material of an equipment element. This type of fatigue fracture is termed thermal fatigue. Of major interest is a comparison of the behavior of materials according to the results of their tests by various methods on taking into account various approaches to estimating resistance to thermal fatigue. Hence the steels EI-852, EI-853, EI-888 and EP-38 were experimentally tested by comparing the number of cycles to fracture under the same thermal conditions (within the same temperature range) in the presence of different mechanical conditions (by linking to the system elements of varying rigidity). Author (TAB)

N70-13745# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
OXIDE FUEL ELEMENT DEVELOPMENT Quarterly Progress Report, 1 Jan.–31 Mar. 1969
31 Mar. 1969 61 p refs
(Contract AT(30-1)-3791)
(WARD-3791-37) Avail: CFSTI

The rupture limits for Type 316 stainless steel are measured, and the effects of annealing and cold working are illustrated. Welding techniques are described for fabricating hexagonal spacer grids of Type 316 stainless steel. Fabrication of PuO sub 2 –UO sub 2 fuel pellets is discussed. Clad swelling equations for Type 304 stainless steel in fast neutron flux are tested for accuracy. NSA

N70-13763# Commissariat a l Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires de Grenoble.
PRODUCTION OF URANIUM STANDARD-SAMPLES FOR SPECTROGRAPHIC ANALYSIS [FABRICATION D'ECHANTILLONS-TEMOINS D'URANIUM POUR ANALYSE SPECTROGRAPHIQUE]
Michele Neuilly and Jean-Claude Leclerc Oct. 1969 31 p In FRENCH; ENGLISH summary
(CEA-R-3911) Avail: CFSTI

This report describes the conditions of preparation of twelve castings of uranium intended for use as reference samples in spectrographic analysis. Results are given of impurity determinations carried out by several laboratories using different methods, together with the "probable values" of the concentrations. Samples of these different castings are now available and can be sent to any laboratory which requires them. Author (ESRO)

N70-13785# Scientific Translation Service, Ann Arbor, Mich. Oak Ridge National Lab., Tenn.
INFLUENCE OF SURFACE TREATMENTS AND COATINGS ON THE EMBRITTLEMENT OF HIGH-STRENGTH STEELS BY HYDROGEN UNDER PRESSURE: CASE OF 35 NiCrMo 16 STEEL
J. D. Fidelle, J. M. Delporo, C. Roux, and M. Rapin 1969 19 p refs Prepared for Oak Ridge National Lab. Transl. into ENGLISH from the Proc. of Interfinish 1968 Seventh Intern. Congr. on Metal Surface Treat. (Hannover), 5–9 May 1968
(PB-185867T; ORNL-TR-2058) Avail: CFSTI CSCL 11F

A rough surface accentuates gaseous hydrogen embrittlement. An improvement of the microgeometrical profile or a superficial compression by blasting improves the life of steel, on the other

hand. Electroplated zinc causes an irreversible embrittlement of the investigated steels. The hydrogen-susceptibility of nickel makes its presence undesirable either as a primary deposit or as a bonding coat. Chromizing of a steel which is to be deformed under hydrogen is not desirable if it cannot favor an austenitic barrier coating there. Encouraging results were obtained with gold and aluminum vacuum metallizing but the findings are not yet reproducible and in the case of gold, the maximum thicknesses which can be deposited without unfavorably affecting cohesion and adherence are small. A thickness of 10-20 micrometers bright electrolytic cadmium deposited after degassing on a heavy high-efficienty cadmium electroplate (30) micrometers) offers promising results.
Author (USGRDR)

N70-13794*# TRW Equipment Labs., Cleveland, Ohio. Materials Technology Dept.
GENERATION OF LONG TIME CREEP DATA ON REFRACTORY ALLOYS AT ELEVATED TEMPERATURES Quarterly Report, 14 Dec. 1967 - 27 Mar. 1968
K. D. Sheffler and E. A. Steigerwald NASA 14 Apr. 1968 71 p refs
(Contract NAS 3-9439)
(NASA-CR-72431; QR-15) Avail: CFSTI CSCL 11F

The creep resistance of molybdenum-base TZC and TZM and of tantalum-base T-111 and ASTAR 811C is being evaluated in a vacuum environment of less than 10 to the minus 8th power torr. Tests from 5000 to 15,000 hours duration are conducted with parameters selected to provide 0.5 to 1.0% total creep. In addition to conventional constant load tests, selected variables are being evaluated with progressively increasing loads. Comparisons of TZC and TZM test results show the influence of composition and thermal-mechanical processing history on 1/2% creep life. At higher temperatures and lower stresses the creep resistance of TZC and TZM are comparable in the stress relieved condition. However, in the low temperature and high stress range, a special heat of TZM processed at higher than normal temperatures and having a higher than normal carbon content shows the best creep resistance. Several short time tests have been conducted on specimens of commercially pure tantalum tubing. T-111 is found to creep at progressively increasing rates under the influence of progressively increasing stress. Various methods for correlating data and for predicting the progressive stress life from static creep tests are discussed.
Author

N70-13835# British Steel Corp., London (England). Metallurgy Div.
DISCUSSION OF THE INFLUENCE OF OXIDATION ON THE RESULTS OF CREEP TESTS
P. Grobner, A. Jakobova, and V. Foldyna 1969 7 p 1969 7 p Presented at the Conf. on Steels for the Power and Csem. Ind., Czechoslovakia, Oct. 1967
(PB-186178; MG/Q/253/68) Avail: CFSTI CSCL 11E

An attempt was made to find a mathematical expression which would make it possible to estimate theoretically the rupture times which would be produced by scale free tests using conventional test results.
USGRDR

N70-13854# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH TEMPERATURE THERMOMECHANICAL TREATMENT OF LARGE STEEL FORGINGS
V. D. Sadovskii et al 29 Apr. 1969 8 p Transl. into ENGLISH from Struktura i Svoistva Zharoprochnykh Metallicheskikh. Materialov (Moscow), 1967 p 246 - 248
(AD-694425; FTD-HT-23-1379-68) Avail: CFSTI CSCL 11/6

This paper evaluates the possibility of using high-temperature thermomechanic treatment (HTTMT) for hardening heavy forgings of experimental steel E1612K. HTTMT may be accomplished under conditions of deformation at rates on the order of 0.5 -1 percent per sec on large forgings. In steel E1612K this treatment produces recrystallized structures in forgings 500 mm in diameter and up to 200 mm thick. HTTMT of forgings of this size increases their hardness and high-temperature resistance with a satisfactory degree of uniformity throughout the cross-section of the forging. The favorable effect of HTTMT is associated with intensification of the aging process, fragmented structure, and distortion of the grain boundaries.
Author (TAB)

N70-13867# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
TRITIUM METROLOGY IN A TOTAL ABSORPTION IONIZATION CHAMBER [METROLOGIE DU TRITIUM EN CHAMBRE D'IONISATION A ABSORPTION TOTALE]
Maurice Blondel and Jean Dalmazzone Sep. 1969 31 p refs In FRENCH; ENGLISH summary
(CEA-R-3886) Avail: CFSTI

Because of its low maximum energy (18 keV), the beta spectrum of tritium can be measured in an ionization chamber with total absorption and fixed sensitive volume. The results obtained are compared with those given by an absolute measurement method using a differential counter. They confirm the possibility of making simple and rapid tritium measurements within a wide range (1 millicurie to 100 curies) with a precision of + or - percent.
Author (ESRO)

N70-13872# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW STAINLESS STEELS AND THEIR WELDING TECHNOLOGY
D. N. Shmakov et al 17 Jul. 1969 8 p Transl. into ENGLISH from Novyematerialy v Mashinostro. (USSR), 1967 p 117 - 124
(AD-693970; FTD-HT-23-22-69) Avail: CFSTI CSCL 11/6

The purpose of the investigation was to develop welding techniques for EP410, EP222, and EI878 stainless steels for use in thin sections. These recently developed alloys are of the maraging type. Samples were cut from plates, welded, and then heat treated. After quenching from 1075-1100 degrees C, EI878 and EP222 steels have an ultimate strength of 70-75 kg/mm (Superscript 2) and a relative elongation of 40 percent (EI878) and 25 percent (EP222). Aging raises the strength to a level of about 100 kg/mm (Superscript 2). All the steels were automatically welded in the as-received condition by using an ADSV-2 machine with a tungsten electrode of 2.5-3 mm diameter. The argon flow rate used was 15-25 1/min. Welding was done with and without a filler wire, which was EP400 (04Kh19N11M3) steel. Welding conditions for these steels are presented. Some samples of EP410 steel were heat treated after welding by tempering either at 625 degrees C for 3 hr or at 425 degrees C for 1 hr, and by quenching from 950 degrees C and then tempering at 425 degrees C for 1 hr. Mechanical properties at plus 20 degrees C and minus 196 degrees C are presented for as-welded samples, with and without heat treatment. Most of the fractures occurred in the base metal. Microstructures and macrostructures of the welded and heat-affected zones are shown. The fusion zone is outlined showing a gradual transition region.
Author (TAB)

N70-13893# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INVESTIGATION OF THE MECHANICAL PROPERTIES OF 30 KhGSA STEEL IN PLASTIC DEFORMATION
N. A. Bukin 31 Jan. 1969 9 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Mashinostro. (Moscow), no. 7, 1967 p 49 - 53
(AD-694422; FTD-HT-23-970-68) Avail: CFSTI CSCL 11/6

Specimens of 30KhGSA steel were subjected to tensile test after standard heat treatment, and also after large plastic deformation followed by stress relieving at 200, 300, 350, or 625C for 2 30 min. The tensile and yield strength of unstrained specimens (118 and 85 kg/sq mm, respectively) slightly decreased with

annealing at 360C for 20 min. The strength of plastically prestrained specimens was not affected by annealing at 200C for 2-10 min. Annealing at 300-370C for 10-30 min slightly increased the strength of the steel. The strengthening effect of annealing depended on the magnitude of relative plastic deformation and averaged 5-10%. However, annealing at 525C for 20 min significantly decreased the yield strength of prestrained specimens. The elastic limit of 30KhGSA steel was 41 kg/sq mm. TAB

N70-13953# Institute of Technology, Helsinki (Finland).
ON THE PASSIVITY OF NI-CR ALLOYS
M. H. Tikkanen and O. Hyvarinen 1969 20 p refs *Its* ACTA Polytech. Scand., Chem. Met. Ser. 85
(PB-186183) Avail: CFSTI CSCL 11F

In the Ni-Cr system there exists in non-oxidizing conditions a critical composition around 14 15 % Cr where the electrochemical behavior of these alloys changes markedly. In more oxidizing conditions this critical composition is changed to 8 9 % Cr in agreement with earlier experimental results. These results show that when predicting the electrochemical behavior according to the electron configuration theory it is necessary to consider the environmental conditions more or less oxidizing.
Author (USGRDR)

N70-13956# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NOTCH SENSITIVITY AFTER VARIOUS METHODS OF THERMOMECHANICAL HARDENING OF STEEL
Yu. V. Shakhnazarov 5 Feb. 1969 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chernaya Met. (USSR), v. 11, no. 2, 1968 p 115-117
(AD-693849; FTD-HT-23-1057-68) Avail: CFSTI CSCL 11/6

Minimum susceptibility to pressure concentrators is provided by high temperature mechanical treatment. During treatment at equal strength, the susceptibility to pressure concentrators after combined thermomechanical treatment is lower than after low temperature mechanical treatment. Intermediate high tempering with subsequent hardening by quenching, improves machinability by means of cutting, and decreases the susceptibility of steel, subjected to thermomechanical treatment to concentrations of pressures.
Author (TAB)

N70-13970# Iowa State Univ. of Science and Technology, Ames.
THE EFFECT OF DISPERSIONS ON THE DUCTILITY OF CHROMIUM
Philip Robert Vormelker (M.S. Thesis) May 1969 51 p refs
(Contract W-7405-eng-82)
(IS-T-314) Avail: CFSTI

Chromium alloys containing up to 7.39 volume % thoria were prepared by powder metallurgy techniques. One alloy series, having an average thoria particle diameter of 1.8 microns, was shown to have a decreasing transition temperature with increasing thoria content. A second alloy series to which thoria of 1.6 microns in diameter was added, showed an interesting transition temperature. The bend yield stress exhibited this same divergent behavior between the two alloy series while the hardness increased over the same thoria concentration range. The divergent behavior between the two alloy series in both transition temperature and yield stress has been tentatively attributed to impurity effects. An attempt was made to confirm the Hahn and Rosenfield model which predicts ductility enhancement for alloys strengthened by a fine, hard particle dispersion. The results of studying chromium-thoria alloys were inconclusive due to the contrast in brittle-ductile transition temperature of the two alloy series and the nonuniformity of the dispersion.
Author (NSA)

N70-14038# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
A STUDY OF PLUTONIUM-SCANDIUM ALLOYS FOR THEIR APPLICATION IN THE ISOTOPIC GENERATORS [ETUDES DES ALLIAGES PLUTONIUM-SCANDIUM EN VUE DE LEUR UTILISATION DANS LES MICROGENERATEURS D'ENERGIE]
Alain Ballagny (Ph.D. Thesis--Paris Univ.) Oct. 1969 60 p refs In FRENCH; ENGLISH summary
(CEA-R-3880) Avail: CFSTI

The limits of the delta stabilized phase have been precisely fixed between 4 and 17 atoms per cent of scandium at room temperature and the coefficients of thermal expansion, the X-ray parameters, the density and the electrical resistivity have been measured. The compatibility of these plutonium-scandium alloys with tantalum for oxidation behavior and certain mechanical properties has been studied.
Author (ESRO)

N70-14039# National Physical Lab., Teddington (England). Chemical Standards Div.
THERMODYNAMIC PROPERTIES OF MAGNESIUM ALLOYS
O. Kubaschewski Nov. 1968 25 p refs
(NPL-DCS-2) Copyright. Avail: CFSTI

This report gives a critical evaluation of the thermodynamic properties of binary alloy systems involving magnesium. Where possible, partial heats and entropies of alloying, integral heats and entropies of formation, free energies, heat capacities on alloying and excess entropies are given. The tables of data relate to magnesium alloys containing lithium, calcium, nickel, copper, silver, zinc etc. and some intermetallic compounds of magnesium.
ESRO

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-12739*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREPARATION OF MIRROR COATINGS FOR THE VACUUM ULTRAVIOLET IN A TWO-METER EVAPORATOR
A. P. Bradford, G. Hass, J. F. Osantowski, A. R. Toft Nov. 1969 26 p refs
(NASA-TM-X-63750; X-283-69-492) Avail: CFSTI CSCL 11C

The design and features of a two-meter evaporator suitable for coating large mirrors uniformly with Al + MgF2 and Al + LiF films of high reflectance in the vacuum ultraviolet are described. The techniques used for monitoring film thicknesses during the film deposition and for producing films of uniform thicknesses over large areas are discussed. It is shown that the Al films for MgF2- and LiF-protected mirrors of highest reflectance in the vacuum ultraviolet down to 1000 A should be 700 to 800 A thick. Data on the vacuum ultraviolet reflectance of Al coated with MgF2 films of various thicknesses are presented. It was found that mirror coatings prepared in a large evaporator have a higher reflectance in the vacuum ultraviolet than those deposited under the same vacuum and deposition conditions in a small vacuum unit. At 1216 A, the reflectance of Al overcoated with 250 A of MgF2 was measured to be about 85%.
Author

N70-12749# Factory Mutual Research Corp., Norwood, Mass.
EVALUATION OF IMPROVED FIRE RESISTANT GLOVE MATERIALS FOR GLOVEBOXES. A GLOVEBOX FIRE SAFETY APPLICATION
P. E. Johnson 1969 16 p refs
(TID-25086) Avail: CFSTI

Samples of silicone rubber sheet and neoprene were tested by the radiant heat panel test and flame test. Results and conclusions are presented.
NSA

N70-12761*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

EFFECTS OF PROLONGED ISOTHERMAL TREATMENT ON THE PROPERTIES OF ZrO SUB 2 REFRACTORY MATERIAL [VLIYANIYE DLITELNYKH BYDERZHEK NA IZMENENIYE SVOYSTV OGNEYPOROV IZ DVUOKISI TSIRKONIYA]

A. G. Karaulov et al Washington NASA Nov. 1969 13 p refs Transl. into ENGLISH from Ogneupory (Moscow), no. 9, 1968 p 45–51
(Contract NASw-1692)
(NASA-TT-F-12675) Avail: CFSTI CSCL 11B

Samples of commercial and chemically pure ZrO2 with various stabilizing admixtures are prepared for study by X-ray and petrographic analysis. Changes observed in the characteristics of ZrO2 (its gas permeability, porosity, durability and elastic modules) as a function of temperature under the influence of prolonged isothermal treatment (1200 to 1700 C) are discussed. The rate and degree of disintegration of ZrO2 is shown to be determined more by the equilibrium concentration of the solid solution at each given temperature than by material purity. Author

N70-12768*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

THERMAL STABILITY OF REFRACTORY CERAMIC MATERIALS IN A HIGH TEMPERATURE GAS FLOW [TERMOSTOYKOST OGNEUPORNYKH KERAMICHESKIKH MATERIALOV V VYSOKOTEMPERATURNOM GAZOVOM POTOKE]

V. I. Dauknis et al Washington NASA Dec. 1969 11 p refs Transl. into ENGLISH from IAEA Symp. on Hydromagnetic Elec. Power Generation, Warsaw, 1968 p 3059–3072
(Contract NASw-1692)
(NASA-TT-F-12652) Avail: CFSTI CSCL 11B

The authors describe the equipment used to investigate the thermal stability of ceramic materials. Several different materials based on zirconium and magnesium were studied. The results showed that above 1600 K the breaking temperature differential increases drastically for all the materials tested. Author

N70-12776# West Virginia Univ., Morgantown. Engineering Experiment Station.

A METHOD OF DETERMINING THE ACTIVATION ENERGY OF THE LONG AND SHORT TIME CONSTANT COMPONENTS OF THE ABSORPTION CURRENT OF CARNAUBA WAX

Nelson S. Smith, Jr. Oct. 1968 33 p refs
(Grant NSF GP-2313)
(PB-185853; Rept-4) Avail: CFSTI CSCL 20C

The apparent ability of many dielectric materials to collect a volume and a surface charge upon the application of a potential difference and then to gradually release this charge upon the removal of the potential difference has long defied complete explanation. A means of separating the charging current, called the dielectric absorption current, into long and short-time constant components and a method of computing the activation energies of these components is outlined. This method of studying the behavior of the activation energies of the components of dielectric absorption currents should prove a useful tool in the development of a more complete theory of the behavior of dielectrics. Author (USGRDR)

N70-12803# Wayne State Univ., Detroit, Mich.

LUMINESCENCE IN CALCIUM TUNGSTATE

Glen P. Double (M.S. Thesis) Sep. 1968 36 p refs Sponsored by AEC and NSF
(COO-1054-44) Avail: CFSTI

Luminescence in calcium tungstate was investigated experimentally as a function of temperature and of wavelength. It was found that the thermoluminescence peaks appear at different wavelengths, indicating more than one luminescence center. A new model for luminescence in calcium tungstate is proposed in which a configuration coordinate diagram is used for each different type of luminescence center. Author (NSA)

N70-12834# California Univ., Berkeley. Lawrence Radiation Lab.

INORGANIC MATERIALS RESEARCH DIVISION Annual Report, 1968

Apr. 1969 248 p refs
(Contract W-7405-eng-48)
(UCRL-18735) Avail: CFSTI

The research reported includes: inorganic chemistry, chemical thermodynamics, solid-state chemistry and physics, electrochemistry, physical chemistry, nuclear science, plastic deformation in Cu polycrystals, dislocations in aluminum, ground states of high temperature vapor species, Zn single crystal sublimation kinetics of evaporation and condensation, energy states of P4 molecules, strengthening brittle matrix composites, and the electronic optical and magnetic properties of solids. F.O.S.

N70-12838*# McDonnell-Douglas Co., Santa Monica, Calif. Advanced Aero/Thermodynamics and Nuclear Effects Dept.

RANKING AND SELECTION OF INSULATION SYSTEMS FOR MNV APPLICATION. SPECIAL REPORT NO. 1: INVESTIGATION OF HIGH-PERFORMANCE INSULATION APPLICATION PROBLEMS

[1969] 129 p refs
(Contract NAS8-21400)
(NASA-CR-102337; DAC-63264) Avail: CFSTI CSCL 11I

Selection of the three most promising insulation systems for Modular Nuclear Vehicle application is discussed. To accomplish a selection it is necessary to rank all candidate systems on the basis of associated vehicle thermal protection weight penalty and insulation system fabricability. Because thermal performance of the insulation is a strong function of layer density, a ranking and selection may be incorrect if improper insulation density values are utilized. A statistical analysis based on the measurement data was accomplished to define the relationship between design thickness and the number of layups which can be expected to be too thin. The minimum practical density parameter was found to be a function of the number of sheets stacked, degree of settling expected and the desired manufacturing acceptance (rejection) rate of initial panel layups. A formalized procedure was developed to relate these parameters in order to define the minimum practical design density. Author

N70-12852# Johns-Manville Research Center, Manville, N.J.

DEVELOPMENT OF 400 TO 1800 F FIBROUS-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS Final Report

J. O. Collins, K. L. Jaunarajs, and D. R. Reid [1969] 300 p refs
(Contract AT(29-2)-2661)
(ALO-2661-12) Avail: CFSTI

An extensive evaluation of submicron particles other than silica was undertaken to provide for a MIN-K product with long term service capability to 2200 F. The mechanism of product failure at elevated temperatures was studied, and attempts were made to prevent or delay this failure. A high density MIN-K formulation was developed and evaluated for 1400 F service as a load-bearing insulation. The effects of product formulation on the thermal conductivity, modulus of elasticity, and load relaxation with time were the primary considerations. GLASROCK 25 foam silica, a relatively low density, low thermal conductivity, high strength refractory was studied with the intent of adding opacifiers for further thermal efficiency. The primary areas of investigation included the effects of the opacifiers on the manufacturing procedure, strength, and thermal conductivity. Author (NSA)

N70-12876# Union Carbide Corp., Oak Ridge, Tenn.
STATISTICAL ANALYSIS OF THE RESULTS OF A SERIES OF EXPERIMENTS ON THE CARBON-FOAM PRODUCTION PROCESS
W. E. Lever (ORNL), J. M. Gerwels, and C. W. Holland 5 Aug. 1969 21 p refs
(Contract W-7405-eng-26)
(Y-1682) Avail: CFSTI CSCL 11C

A statistical analysis was performed on the results of four experiments conducted on the carbon-foam production process. The factors that appeared to be most important in the production of carbon-foam castings were identified. Author (NSA)

N70-12890# Technische Hogeschool, Delft (Netherlands). Dept. of Applied Physics.
SOME THEORIES OF FLUIDIZED BED COATING
Muharrem Elmas 1969 71 p refs
(PB-186300) Avail: CFSTI CSCL 13H

A general theory was proposed to account for the dip-coating process in a fluidized bed. Although approximate temperature profiles of the form of a second or third degree polynomial can be used, nevertheless the upper and lower bounds for the coating thickness were found by using the fact that the values of the integrals in the denominators of the equations giving the coating thickness are not very sensitive to small variations in the kernal function. By assuming that under homogeneous fluidization conditions both the coating layer and the region of the bed next to this layer have a common physical structure, simple mathematical relations for the rate of the growth of the coating layer has been established. The coating theory developed was extended to include a different boundary condition: the heating of the object in the fluidized bed. Inclusion of such a boundary condition allows one to treat the coating of continuously moving objects, i.e. wires, metal strips, in a more formal manner. Author (USGRDR)

N70-12892# Bureau of Mines, Washington, D.C.
OXYGEN CONSUMPTION AND HYDROGEN PRODUCTION BY SHRINK-RESISTANT GROUTS IN CONFINED PLACES
Mary A. Barrett Jun. 1969 13 p
(PB-184814; BMRI-7267) Avail: CFSTI CSCL 11B

A laboratory scale investigation was conducted of growing mixtures containing iron or aluminum to determine the existence of health or explosion hazards, due respectively to oxygen depletion or hydrogen emission. Author (USGRDR)

N70-13068# Technische Hogeschool, Delft (Netherlands).
FUNDAMENTAL ASPECTS OF FLUIDISED BED COATING
Muharrem Elmas (M.S. Thesis) 1969 88 p refs
(PB-186299) Avail: CFSTI CSCL 11C

The thesis discusses the important parameters in fluidized bed processes. Contents: Fluidization; Particle motion in a fluidized bed; Thermal properties of the fluidized bed; The mechanism of the coating process; Experimental results and their interpretations for polymers with heat of fusion (polyethylene); Coating of continuously moving axially symmetric objects; Some practical considerations and conclusions. USGRDR

N70-13064# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
NONCIRCULAR CYLINDRICAL SHELLS OF PYROLYTIC GRAPHITE TYPE MATERIALS Technical Report
R. L. Daugherty and J. R. Vinson Nov. 1968 42 p refs
(Grants NSF GK-684, NSF GK-3878)
(PB-186282; TR-95) Avail: CFSTI CSCL 11B

A formulation of the governing equations for shells of arbitrary shape of transversely isotropic materials accounting for thermal strains across the shell thickness and transverse shear deformation is presented. This set of equations is then solved for the case of a noncircular cylinder using an asymptotic expansion procedure. The method uses two asymptotic series, which combined with the particular solutions, give the total solution. The final form of the solution presented contains the arbitrary functions to be determined from the boundary conditions. The solution for the special case of a shell of isotropic material is also given. Author (USGRDR)

N70-13249# United States Industrial Chemicals Co., New York.
CREEP BEHAVIOR OF CROSS LINKED POLYETHYLENE
Gerard W. Kuckro, J. A. North, and George E. Lorand 1968 45 p refs Presented at 17th Intern. Wire and Cable Symp., Atlantic City, 4 – 6 Dec. 1968
(AD-677822) Avail: CFSTI CSCL 11/9

In a vulcanized polyethylene, creep is a sensitive measure of the thermal stability of the compound. Creep is dependent upon time, temperature, applied load, state of cure and formulation. The creep test is very responsive and very versatile since the conditions are readily altered to fit the polymer under study; it is many times faster than conventional aging methods, and correlates well with accelerated oven aging; and it has a wider span of utility in that it monitors a polymer's useful life anywhere between incipient to gross degradation. Creep varies directly with the percent extract and swelling ratio and indirectly with the hot modulus. Also, creep provides an accurate approximation of the degree of crosslinking. Author (TAB)

N70-13283# Bureau of Reclamation, Denver, Colo. Chemical Engineering Branch.
EFFECTS OF CATHODIC PROTECTION ON PROTECTIVE COATINGS
T. E. Backstrom and F.E. Causey Feb. 1969 22 p refs
(PB-184734; ChE-71) Avail: CFSTI CSCL 11F

A test was performed to evaluate the effect of higher cathodic protection levels on newly applied protective coatings. The coatings were chosen to represent coatings normally used on Bureau of Reclamation projects. Author (USGRDR)

N70-13326# Maryland Univ., College Park. Radiation and Polymer Science Lab.
RADIATION-INDUCED GRAFTING OF STYRENE TO POLYETHYLENE
Sueo Machi and Joseph Silverman [1968] 20 p refs Presented at the Symp. on Util. of Large Radiation Sources and Accelerators in Ind. Process., Munich, Aug. 1969
(CONF-690805-4) Avail: CFSTI

Grafting experiments have been performed on styrene over a range of gamma dose rates from 1000 to 300,000 Rad/hr using polyethylene in film and single crystal form, as well as ethylene – propylene rubber. Data were obtained on the kinetics of covalent grafting, the formation of occluded homopolymer, and bubble characteristics as a function of irradiation and soaking conditions. Bubble formation was found to be a sensitivie function of soaking conditions. A polyethylene film sample irradiated at 1000,000 Rad/hr for 5 hours showed a weight gain of 50% after a five minute soak in benzene. Aside from a slight increase in opalescence, no bubbles could be observed using ordinary methods of optical microscopy. The time threshold for bubble formation was 10.8 hr by which time the net weight gain of the film was 42%; up to this point, the film was an almost homogeneous blend of the matrix, the occluded homopolymer, and the covalent graft. NSA

N70-13341# Steel Structures Painting Council, Pittsburgh, Pa.
MEASUREMENT OF PAINT FILM THICKNESS Interim Report
John D.Keane and JoAnne Chiavetta 1 Aug. 1969 23 p refs
(Contract PDH-42659)
(PB-185669; IR-1) Avail: CFSTI CSCL 11C

The document contains a literature review through mid-1969 of current methods for measuring paint film thickness on steel. The purpose of this review has been to avoid duplication of work that others have done in the past, and to take full advantage of all pertinent information that can be used to plan current experimental study on this subject. Author (USGRDR)

N70-13429# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROPERTIES OF THE SYSTEM POLYVINYL CHLORIDE AND PLASTICIZER

I. P. Rotenberg et al 14 Feb. 1969 15 p refs Transl. into ENGLISH from Plasticheskie Massy (Leningrad), no. 1, 1968 p 8-12

AD-693853; FTD-HT-23-1062-68) Avail: CFSTI CSCL 11/9

An important condition in obtaining porous polyvinyl chloride PVC by the method of saturating the paste with a gas or with low-boiling liquids is the correct selection of the composition of the resin & plasticizer system. The following are necessary properties of such a system: good compatibility of the resin with the plasticizer, stability of the paste during storage, adequate stability of the saturated raw foam in atmospheric conditions, the greatest possible time to the beginning of coalescence of the foam during warm-up, and a high tangent of dielectric loss angle, which is an important factor during high-frequency warm-up of the foam. On the basis of the experimental results it was proposed to evaluate the action of plasticizers on PVC and to select a system which will ensure obtaining a stable foam and a cellular structure of the poroplastic. The following characteristics of polyvinyl chloride pastes were defined: Compatibility of PVC with the plasticizer; Change in viscosity of the paste during storage; Dependence of paste viscosity on temperature; Change in the rheological properties of the paste during the application of shear force in the interval 100-190 C; Critical temperature of dissolution of the resin in low-concentration dispersions; Degree of gelatinization and fusion temperature; and Dependence of the tangent of dielectric loss angle on temperature.

Author (TAB)

N70-13554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF STUDYING POLYURETHANE COATINGS BY INFRARED SPECTROSCOPY

V. A. Khranovskii 16 May 1969 9 p refs Transl. into ENGLISH from Sintez i Fiz.-Khim. Polyuretanov (Kiev), 1967 p 174-176

(AD-693945; FTD-MT-24-129-69) Avail: CFSTI CSCL 11/3

A method and apparatus for determining the structure of anticorrosive polyurethane coatings is described which is based on the recording of the IR spectrum of compounds present as thin layers on a reflecting surface. An optical system and a cryostat were designed for structural studies at -196 C and at temperatures to 300 C.

Author (TAB)

N70-13568# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF MOLYBDENUM DISULFIDE FILMS

A. P. Babichev et al 13 May 1969 8 p Transl. into ENGLISH from Mashinostroitel (Moscow), no. 5, 1968 p 23-24

(AD-694398; FTD-HT-23-149-69) Avail: CFSTI CSCL 11/8

Experiments were conducted in applying a molybdenum disulfide film as lubricant in the vibro-tumbling process. The process was found to improve the microgeometry and mechanical properties of steel roller bearings. The durability of molybdenum disulfide alone was compared to that of a 1 to 1 ratio mixture of molybdenum disulfide and graphite. Friction coefficients were roughly equal at various loadings but film durability ranged from 2 hr 33 min for molybdenum disulfide and 1 hr for molybdenum disulfide plus graphite down to 2 hr and 7 min for molybdenum disulfide and 23.5 for molybdenum disulfide plus graphite. The effect on film duration of rate of application of molybdenum disulfide films and of surface cleanness, and methods of cleaning bearing surfaces, are discussed.

TAB

N70-13583# Union Carbide Corp., Parma, Ohio. Carbon Products Div.

CHEMICAL VAPOR DEPOSITION OF BORON CARBIDE Final Report, 1 Jul. 1968-30 Jun. 1969

Arthur W. Moore and Herbert F. Volk Aug. 1969 47 p refs (Contract DAAG48-68-C-0114)

(AD-693882; AMMRC-CR-69-10) Avail: CFSTI CSCL 11/2

The chemical vapor deposition of boron carbide B4 C was studied with the objective of preparing unusually hard specimens. specimens. Diamond pyramid microhardnesses at 100 gram load as high as 4800 kg/sq mm 20 percent greater than the value of 4000 kg/sq mm for hot-pressured B4 C were obtained in deposits prepared from BC 13 and Ch4 at 2000-2100 C. Massive specimens of such deposits could not be produced, but thick deposits were obtained at 1300 C using a large excess of H2 and Ch4 with the BC l3. Hardness and modulus of these low temperature deposits were normal 4,000 kg/sq mm and 58,000,000 lb/sq in., respectively, and were not increased by thermal annealing. Doping of B4 C with silicon or titanium had no substantial effect on hardness.

Author (TAB)

N70-13690# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NEW ELECTROPLATED BLACK COATING: BLACK CHROMIUM

Hsiho-Feng Hsu 4 Mar. 1969 11 p Transl. into ENGLISH from Shang Hai Chi Hsieh (China), no. 2, 1965 p 12-13

(AD-693836; FTD-HT-23-626-68) Avail: CFSTI CSCL 11/3

A description is given of the electroplating of black chromium coating for use on instrument components to eliminate glare and to prevent corrosion. Plating is conducted in a solution of chromic anhydride and sodium nitrate for a period of 20 minutes at a current density of 30-60 amp/sq dm and a temperature of 15-40C. A lead-tin alloy (7 percent tin) is used as the anode, and the chromium oxide content in the solution is regularly checked by the Hull cell test for replenishment. Coating thickness determined by metallographic method is 4.8 microns at a 20 min period and current density of 60 amp/sq dm. The coating, containing a mixture of 75 percent chromium and 25 percent chromium oxide can be directly plated on aluminum and stainless steel components, and on iron components with undercoats of low tin-containing bronze. Results from humid heat tests and salt fog tests showed that the black chromium coating exhibits a better quality than the black nickel coating or bluing. Defects likely to occur in plating and their remedies are also given.

Author (TAB)

N70-13693# Atomic Energy of Canada, Ltd., Ottawa (Ontario). Commercial Products.

PLASTIC IMPREGNATION OF FIBROUS MATERIALS: AN ANALYSIS OF THE ECONOMICS OF VARIOUS CURING METHODS [PLASTIMPREGNERING AV FIBERMATERIAL: ANALYS AV OLIKA HAERDNING SMETODERS EKONOMI]

Eric Rotkicch Apr. 1969 67 p refs Transl. into ENGLISH from Paper and Wood no. 4, 1968

(AECL-3327) Avail: CFSTI

The comparative economic merits of various monomer curing methods are discussed, and calculated figures for the irradiation method as well as for the catalytic are given: It is shown, that the dominating cost in manufacturing wood plastic combinates or polymerimpregnated plywood, fiber and chipboard etc. is the cost of chemicals. The curing costs are of the order of 10 % of the total processing costs. A closer study however indicates, that radiation curing has some merits as compared with the catalytic method. The above mentioned large cost portion occupied by impregnation chemicals leads to the conclusion, that impregnation of surface layers in various board materials and coating solid wood with polymer impregnated veneer sheets will be the most economic proposals.

Author

N70-13741# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
FIBER-REINFORCED GRAPHITE COMPOSITE FABRICATION AND EVALUATION
F. Lambdin, J. L. Cook, and G. B. Marrow 4 Sep. 1969 57 p refs
(Contract W-7405-eng-26)
(Y-1684) Avail: CFSTI

Composites consisting of carbon fibers (2 microns in diameter by 10 mils long), and either of a thermoplastic or thermosetting resin, were spray formed onto graphite mandrels, carbonized to 1,000 C, and densified by repeated impregnation–carbonization cycles. Sections up to one inch in thickness and ranging in density from 0.2 to 1.7 g/cc have been fabricated using spraying as the basic fabrication method. Isostatic and match-die compaction were used to increase the fiber population. Preliminary physical and mechanical properties of these composite materials were evaluated, and several were investigated to determine their performance under ablation conditions. Author (NSA)

N70-13750# Mound Lab., Miamisburg, Ohio.
IMPROVEMENTS IN SURFACE COATINGS Patent
R. G. Millet 8 Oct. 1969 10 p Transl. into ENGLISH from French Patent No. 1406882 (British Appl. No. 36195/1963, 13 Sep. 1963)
(Contract AT(33-1)-GEN-53)
(PB-186213T; MLM-1676(TR)) Avail: CFSTI CSCL 13H

The metal compound to be thermally decomposed is put into an inert liquid medium or formed in one. The medium, which has a boiling point lower than the decomposition temperature of the compound, is brought to boiling to volatilize the compound. In this way some mixed vapors are freed, and a stream composed only of those vapors continually passes over the heated substrate in the decomposition chamber. Thus, some plating metal is deposited on the substrate, coming from vapors which contacted the heated surface. The vapors which are not decomposed from the metal compound are then condensed for reuse. Author (USGRDR)

N70-13760# Battelle-Northwest, Richland, Wash.
VIBRATIONALLY COMPACTED CERAMIC FUELS
M. D. Freshley and T.B. Burley Feb. 1969 53 p refs Presented at Enlarged Halden Programme Group Meeting, Roeros, Norway
(Contract AT(45-1)-1830)
(BNWL-SA-2412; Conf-690323-2) Avail: CFSTI

Vibrationally compacted ceramic fuels have been irradiated in PRTR, EBWR, and commercial BWR's and PWR's to peak burnups of nearly 34,000 MWd/mtm. Irradiations in PRTR are being conducted at peak power generations of nearly 20 kW/ft with maximum fuel temperatures near melting. Peak burnups in PRTR are over 18,000 MWd/mtm. Fuel melting occurs in 86% TD vibrationally compacted UO sub 2–2 wt % PuO sub 2 fuel rods at a linear rod power of 855 + or – 15 W/cm under PRTR conditions which is equivalent to a thermal conductivity integral value of 80 W/cm. In-reactor sintering and densification of the fuel cause restructuring to occur relatively rapidly during irradiation although time-temperature dependent sintering effects cause more subtle structural changes to occur. During extended exposures, data indicate that the in-reactor columnar grain growth temperature in pneumatically impacted UO sub 2–PuO sub 2 fuel is approximately 1800 C. The indicated sintering temperature is approximately 1700 C. Author (NSA)

N70-13761# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT-RESISTANT MATERIAL WITH SILICON CARBIDE AS A BASE
S. A. Tsukerman et al 13 May 1969 11 p Transl. into ENGLISH from Poroshkovaya Met. v Novoi Tekhnike (Moscow), 1968 p 63–67
(AD-693859; FTD-MT-24-64-69) Avail: CFSTI CSCL 11/4

A new high-temperature material, termed SG-60, is a silicon carbide-graphite composite in which the graphite is the thermostability carrier since it is more heat-conducting and softer (heat conductivity of graphite is 0.57 cal/g-cm-sec compared with 0.02 cal/g-cm-sec for silicon carbide) while silicon carbide is the carrier of high-temperature strength and hardness. The high covalent bonding strength of the atoms of silicon carbide (283 kcal/mole) accounts for its high decomposition temperature (above 2500 degrees C) (without melting) and hardness. This composite is obtained by means of thermochemical treatment of porous graphite with silicon in both liquid and gaseous states. In such a composite the positive properties of phase components (high oxidation resistance of SiC, high thermostability of graphite) can be combined while their negative properties (low thermostability of SiC, low hardness and strength of graphite) can be to some extent neutralized. Author (TAB)

N70-13860# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
INFLUENCE OF THE FILLERS ON THE PROPERTIES OF ADHESIVES [INFLUENCE DES CHARGES SUR LES PROPRIETES DES ADHESIFS]
Samuel Kohn 1969 38 p refs In FRENCH; ENGLISH summary Presented at the Colloq. on Adhesives, Abbaye de Valduc, France, 17–18 Apr. 1969 Submitted for publication
(ONERA-TP-733) Avail: CFSTI

After a morphological classification of the fillers, the different interactions between polymers and fillers are reviewed and emphasis is placed on the properties of composites made from reinforced plastics. A more detailed description of the influence of the filler on the following points is then given: the handling conditions of the adhesives, the mechanical properties of the plastics and the thermal behaviour of the plastics. Finally it is shown that the thermal stability of a phenolic resin can be increased by adding moderate parts of inorganic oxides. Using such a resin, a metal-metal adhesive withstanding 300°C during hundreds of hours may be made up. Author (ESRO)

N70-13886# Air Force Systems Command, Wright-Patterson, AFB, Ohio. Foreign Technology Div.
METHOD OF INCREASING THE OXIDATION RESISTANCE OF THE PETROLEUM LUBRICANT INDUSTRIAL-12
S. Z. Kaplan et al 13 May 1969 5 p Transl. into ENGLISH from Russian Patent no. 187914 (Appl. no. 1015551/23-4, 30 Jun. 1965) 1 p
(AD-693951; FTD-HT-23-125-69) Avail: CFSTI CSCL 11/8

Increase of oxidation resistance of petroleum lubricant industrial-12, involves introduction as antioxidants of a derivitive of methylmorpholine. In order to increase the assortment of additives dibensoate of 2,2-bis-(morpholinomethyl)propanediol-1,2 is used. The comparative results of the action of different antioxidants at 160 degrees C in the atmosphere of oxygen are given in a table in the original patent. Author (TAB)

N70-13899# National Physical Lab., Teddington (England). Inorganic and Metallic Structures Div.
FIBRE REINFORCEMENT OF MATERIALS
J. A. Champion Sep. 1969 23 p refs
(NPL-IMS-5) Copyright. Avail: CFSTI

Many materials in fibrous form possess higher strength/weight and stiffness/weight ratios than those of conventional structural materials. In order to utilise these superior properties the fibres must be incorporated in an appropriate matrix to produce a tough, stable material that is resistant to oxidation and corrosion. The principle of fibre reinforcement is being applied with metallic and non-metallic fibres in metallic, polymer and ceramic matrices. Problems associated with the fabrication and performance of these composite materials are discussed. Author (ESRO)

N70-13943# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.
NUCLEAR MAGNETIC RESONANCE INVESTIGATIONS OF FAUJASIT-TYPE ZEOLITES CONTAINING NICKEL [KERN-SPINRESONANZUNTERSUCHUNGEN AN NICKELHALTIGEN ZEOLITHEN VOM FAUJASITTYP]
Jan Amthor (Ph.D. Thesis) 1968 87 p refs In GERMAN
Avail: CFSTI

Nuclear magnetic resonance measurements on Faujasit-type zeolites containing nickel are reported. In these synthetic zeolites, the sodium ions have been exchanged to a varying degree for bivalent ions, nickel or calcium. The mobility of adsorbed molecules and of the cations, as well as the positions of the cations in the lattice were determined from the variations of the line-width of the proton and Na^{23} resonances. It was found that the dehydration of the zeolites was reversible below 200°C but irreversible at higher temperatures. ESRO

N70-13991# Union Carbide Corp., Oak Ridge,Tenn. Y-12 Plant.
CARBON COMPOSITE MATERIALS (SECOND ISSUE)
L. M. Mc Laughlin 18 Sep. 1969 314 p
(Contract W-7405-eng-26)
(Y-DA-2654) Avail: CFSTI

Reviews are presented on fabrication methods and properties of carbon-base thermal insulation, properties of pyrolytic graphite, fibrous graphite, and carbon foam, preparation and properties of high-carbon compounds, properties of porous graphite, and morphology of rigid-foam carbon. NSA

N70-14023# Central Technical Inst., TNO, Delft (Netherlands).
THERMAL SHOCK INVESTIGATIONS
J. A. Knobbout and N. van Bezooyen Oct. 1969 11 p Sponsored by ELDO
Avail: CFSTI

Thermal shock tests were performed on aluminium tanks insulated with polyphenylene oxide (PPO) foam. The desired thermal shock sequence was obtained by filling the tank with liquid nitrogen, emptying it and then heating it. The insulation system consisting of PPO foam sealed with foil and bonded to an aluminium wall was found capable of sustaining severe thermal shocks without damage. ESRO

N70-14049# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF OPTICAL GLASS PROPERTIES ON THE COOLING PROCESS
V. I. Primenko 31 Jan. 1969 6 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk. Ukr. URSR (Kiev), no. 10, 1966 p 1321–1322
(Contract F33657-68-D-0865-2)
(AD-693850; FTD-HT-23-844-68) Avail: CFSTI CSCL 11/2

The effects of optical glass properties on the process of cooling and annealing were studied. Equations were derived for the calculation of residual stresses in blocks of two grades of glass: TK = 14 and TK = 21. TAB

N70-14069# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEPOSITION OF REFRACTORY COATINGS WITH THE USE OF PLASMA
T. A. Nimvitskaya et al 13 May 1969 14 p refs Transl. into ENGLISH from Proc. of the 3rd Seminar on Temp. Resistant Protective Coatings, Leningrad, 1966 (Leningrad), 1968 p 205–215
(AD-694400; FTD-HT-23-176-69) Avail: CFSTI CSCL 11/3

The effects of metal surface preparation and of plasma deposition conditions on the properties of deposited refractory coatings were examined. The coating of low and medium carbon steel with aluminum oxide (30-70 micron) or aluminum oxide containing oxygen-resistant enamel or base enamel was carried out using a plasma apparatus and argon, nitrogen, helium, or their mixtures as plasma-forming gases. Optimum distance between plasma generator and surface of the material to be coated was 150-200 mm. Comparison of different gas mixtures showed the mixture of nitrogen plus 10 percent helium most effective. The metal surfaces were prepared by various methods--sandblasting with subsequent sodium nitrite passivation, sulfuric acid etching at 70C with washing and neutralizing, chemical nickel or cobalt plating, or conventional coating with base enamel. Plasma deposition of the aluminum oxide onto the nickel - or cobalt-plated metal resulted in poor adherence to the metal. Deposition onto the enamel-primed material gave coatings with good impact resistance that withstood thermal cycling better than did coatings deposited directly on the metal. TAB

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-12753# Oak Ridge National Lab., Tenn.
A NOTE ON THE APPLICATION OF LIE GROUPS TO THE INTEGRATION OF FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS
Lawrence Dresner 4 Sep. 1969 21 p
(ORNL-TM-2690) Avail: CFSTI

The solution of first-order partial differential equations in two independent variables that are invariant under the transformations of a two-parameter group is studied. The equations need not be linear. Author (NSA)

N70-12756# Wisconsin Univ., Madison. Mathematics Research Center.
ORTHOGONAL POLYNOMIALS AND POSITIVITY
Richard Askey Amsterdam Math. Centrum Aug. 1969 37 p refs
(Contracts DA-31-124-ARO-D-462; N00014-67-A-0128; Grant NSF GP-6764)
(AD-692907; TW-112) Avail: CFSTI CSCL 12/1

The literature of special functions is full of explicit formulas, some extremely useful and some of no value at all. While much of the rest of mathematics is no longer as constructive as it was in the eighteenth century, this is not true in the theory of special functions. There are times when the specific formulas obtained are not useful for certain problems, while a general property, say the positivity of some kernel, is the essential fact that is needed. We will give some instances of this, at times when we can not find a specific formula at all and other examples when a specific formula can be found but the positivity must be obtained by a different argument. Author (TAB)

N70-12757# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
COMMENTS ON PRACTICAL APPLICATION OF GAME THEORY
John E. Walsh 29 Jul. 1969 11 p refs Sponsored in part by Mobil Res. and Develop. Corp.
(Contract N00014-68-A-0515)
(AD-693045; THEMIS-SMU-TR-40) Avail: CFSTI CSCL 12/2

Much effort has been devoted to development of game theory. However, nontrivial practical applications are few. One reason may be difficulties in evaluating payoff matrices. Another reason may be the very limited extent of situations for which game solutions of a forcing nature have been developed. That is, the solutions control (force) what the players can do, according to some reasonable criterion (such as expected payoff received), rather than merely trying to predict what they will do. A third reason may be that

very little has been developed for situations where the numbers in a payoff matrix do not satisfy the arithmetic operations. As an example, this occurs for the practically important case where the ranks of the payoff values are the numbers in a payoff matrix. These three restraints on game theory use are discussed. Then, attention is directed to a new form of game theory that is much less sensitive to these restraints. Author (TAB)

N70-12790# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

ON THE NUMERICAL SOLUTION OF BOUNDARY-VALUE PROBLEMS FOR ELLIPTIC DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS

I. V. Didenko et al 15 Aug. 1969 17 p refs Transl. into ENGLISH from Ukr. Mat. Zh. (Kiev), v. 16, no. 5, 1964 p 681 - 690
(Contract NOw-62-0604-C)
(AD-693366; APL-CLB-3-T-594) Avail: CFSTI CSCL 12/1

Let g sub k (k = 0,...,m) be rectangles with sides parallel to the coordinate axes in R sub 2 and assume that the g sub k (k = 1,...,m) all intersect g sub o. Let G = (U sub k, superscript m) - (O superscript g)k and consider the Dirichlet problem in G for the equation delta u - lambda u = f, lambda = or > 0. The problem is discretized by means of the ordinary five-point formula, and the resulting finite linear system of equations is solved by an iterative scheme, which is a finite-difference analog of the Schwartz alternating procedure from potential theory, using the fact that for a single rectangle the solution admits an explicit representation in the form of a finite sum. Author (TAB)

N70-12848*# Brown Univ., Providence, R.I. Center for Dynamical Systems.

PROBABILITY LIMIT THEOREMS AND THE CONVERGENCE OF FINITE DIFFERENCE APPROXIMATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Harold J. Kushner Oct. 1969 48 p refs
(Grants NGL-40-002-015; AF-AFOSR-67-0693A; NSF GK-2788)
(NASA-CR-107124; CDS-TR-69-4) Avail: CFSTI CSCL 12A

A bounded open set in a Euclidean r-space with a continuous boundary and non-negative continuous functions on the Euclidean r-space are assumed. Possibly degenerate elliptic or parabolic equations are considered in either of three forms. The three equations are given a 'physical' probabilistic interpretation which is used heavily in interpreting the finite difference equations, in the motivation of the development, and in the convergence proofs. R.B.

N70-12858# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

TESTING EQUALITY OF MEANS IN A P-VARIATE NORMAL DISTRIBUTION HAVING EQUAL VARIANCES AND EQUAL CORRELATION COEFFICIENTS

Jerrell T. Stracener 16 Jul. 1969 39 p refs
(Contract N00014-68-A-0515)
(AD-693043; TR-39) Avail: CFSTI CSCL 12/1

The null hypothesis H sub zero: mu = mu*, where mu and mu* are p x 1 vectors is to be tested on the basis of a sample of size n, from a p-variate normal population having equal variances and equal correlation coefficients. Since mu can be either specified or unspecified, and sigma squared and rho can be either known or unknown, there are eight cases of the null hypothesis to consider. One of these cases has been considered by S. S. Wilks. In this paper four of the remaining seven cases are considered. The test criterion will be derived by the likelihood-ratio method for each case. TAB

N70-12875# Sandia Corp., Albuquerque, N.Mex.

COMPUTATION WITH THREE-TERM, LINEAR, NONHOMOGENEOUS RECURSION RELATIONS

D. E. Amos and J. W. Burgmeier Jul. 1969 46 p refs Sponsored by AEC
(SC-RR-69-485) Avail: CFSTI

The problem of stable computation by forward and backward recursion on three-term, linear, nonhomogeneous recursion relations is outlined. The backward recursive theory is applied to integrals commonly arising in mathematical physics, including incomplete Laplace transforms of repeated integrals of the error function, moments of some Bessel functions, and the incomplete gamma function. Author (NSA)

N70-12898*# California Univ., La Jolla. Dept. of Applied Physics and Information Science.

THE APPLICATION OF PROLATE SPHEROIDAL WAVE FUNCTIONS TO THE DETECTION AND ESTIMATION OF BANDLIMITED SIGNALS

Charles L. Rino [1969] 7 p refs
(Grant NGL-05-009-079)
(NASA-CR-107122) Avail: CFSTI CSCL 12A

A solution to the detection Fredholm equation for bandlimited noise and signal is presented that makes use of the dual orthogonality and completeness of the prolate spheroidal wave functions. Although data are available only on a finite interval, the detector in principle achieves the same optimum performance as if the interval were infinite. This apparent anomaly is resolved in an example. Author

N70-12909# California Univ., Livermore. Lawrence Radiation Lab.

TWO-DIMENSIONAL POWER SERIES APPROXIMATION OF EQUATION-OF-STATE SURFACES

H. P. Richter 16 Apr. 1969 10 p refs Sponsored by AEC
(UCRL-50643) Avail: CFSTI

A method based on a two-dimensional power series is shown to be superior to other methods for approximating equation-of-state surfaces. Its major advantage is that it yields a single set of coefficients valid over the entire surface, rather than multiple sets each valid in only a restricted zone. The method is illustrated by applying it to a surface, defined by a compression curve and three release isentropes, obtained from shock experiments on reconstituted tuff (an earth material). All points examined on this experimental surface are approximated to within a few percent, the majority within 1 percent. An outline is given for applying the two-dimensional power series method to evaluation of theoretically derived equations of state. Author (NSA)

N70-12913# Northwestern Univ., Evanston, Ill.

SOFT PION EVALUATION OF MASS DIFFERENCE, GAUGE INVARIANCE, AND SPECTRAL FUNCTION SUM RULES

N. G. Deshpande 1968 10 p refs Presented at Theoret Phys. Inst., Denver, 1968 Sponsored by NSF
Avail: Issuing Activity

A sum rule that retains the good features for SU(2) × SU(2) while giving large corrections to chiral SU(3) predictions suggested itself from the requirement that the pion mass difference be convergent with massive pions in the intermediate state. It is shown that off-mass-shell extrapolation of a matrix element leads to a loss of gauge invariance, and some prescriptions are given to restore it. Gauge invariant formulation of mass difference is reviewed and the results are used to study the soft pion calculation. The asymptotic SU(3) method of obtaining sum rules is summarized and applications of the new sum rule are given. R.B.

N70-12928*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON KRUSKAL'S PERTURBATION METHOD

David P. Stern Dec. 1969 15 p refs Submitted for publication
(NASA-TM-X-63753; X-641-69-515) Avail: CFSTI CSCL 12A

A general method for eliminating the angle variable from the equations of a perturbed periodic motion and for deriving an

"adiabatic invariant" J has been given by Kruskal, and for a special class of Hamiltonian systems, McNamara and Whiteman have shown that J is related to a set of invariants I obtained from the expansion of Poisson bracket relations. In this work, an order-by-order algorithm for Kruskal's method is introduced and a new set of invariants Z1 is obtained. It is shown that these invariants bear a close relation to those obtained from the Poisson bracket expansion, and in the special case investigated by McNamara and Whiteman, the relation between I and Z1 may be brought to the same form as the relation between I and J derived by those authors. Finally, the relationship between Z1 and J is examined and arguments are presented that in certain cases the two are equal to all orders. Author

N70-12941# Sandia Corp., Albuquerque, N.Mex.
ADAPTIVE NONLINEAR PREDICTION AND CONVERGENCE RATES
D. A. Dahlgren (Ph.D. Thesis—New Mexico Univ.) Sep. 1969 110 p
(PB-186 204; SC-RR-69-484) Avail: CFSTI CSCL 12A

The report discusses prediction using maximum-likelihood estimators, examples of prediction using maximum-likelihood estimators, prediction using the estimator of Ho and Lee, and single-station wind predictin. USGRDR

N70-12946*# Martin Marietta Corp., Denver, Colo.
CONTROLLABILITY OF NONLINEAR SYSTEMS WITH LINEARLY OCCURRING CONTROLS
George W. Haynes Washington NASA Dec. 1969 77 p refs (Contract NAS2-4898)
(NASA-CR-1463; MCR-69-254) Avail: CFSTI CSCL 12A

The equivalence between two criteria for the controllability of linear time varying systems can be established by the linear dependence of the input/output functions on the real line, and the various degrees of independence has generated various definitions of controllability. The mathematical concepts of the geometry of manifolds required for the differential geometric approach to controllability are developed. A special class of nonlinear control systems is considered where the time coordinate is an ignorable coordinate and global conditions where the time coordinate is an ignorable coordinate and global conditions for controllability in terms of noninvolutive systems are derived. Since linear systems are basically involutive, it is shown that the skew symmetry of the vector fields about the origin implies full nieghborhoods of attainable points, rather than one-sided sets of attainable points and this is why the algebraic tests for controllability, despite the monotonicity of the time coordinate, are valid. Involutive nonlinear systems are examined and some meaningful equivalences are developed between the control actuator vectors defining an involutive distribution and the existence of totally singular vector controls. Some nonautonomous versions of techniques employed are used to determine controllability criteria. R.B.

N70-12947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECT AND INDIRECT EVALUATION OF THE CUMULATIVE BINOMIAL FUNCTION ON A DESK-TOP-TYPE ELECTRONIC COMPUTER
Darl D. Bien and Robert E. English Dec. 1969 12 p ref
(NASA-TM-X-52728) Avail: CFSTI CSCL 12A

Two programs for the cumulative binomial function are presented. The direct program computes the cumulative binomial sum C for specified values of n, r, and p. The indirect program computes the binomial parameter p for specified values of n, r, and C. The programs, which are suitable for $n < or = 1000$, are useful in applications such as reliability, industrial sampling, and statistics. Author

N70-12952# Oak Ridge National Lab., Tenn.
INTEGRAL SOLUTIONS TO THE GENERALIZED HELMHOLTZ EQUATION
Philip B. Burt 1 Jul. 1969 11 p refs Submitted for Publ. Prepared in cooperation with Clemson Coll.
(PB-184913; ORNL-TM-2658) Avail: CFSTI CSCL 12A

A method of solution of the differential equation (O + K squared (x)) Psi = O, where O is a linear, second order differential operator, is discussed. The method is based upon approximating K squared (x) by a series of step functions whose strength is the value of K squared in the specific interval. The relation of this method of solution to the W.K.B. approximation and the Born approximation is exhibited. Author (USGRDR)

N70-12954# Michigan Univ., Ann Arbor.
MATHEMATICS OF OPERATIONS RESEARCH Final Report, 17 Nov. 1965 - 16 Nov. 1968
Robert M. Thrall 7 Aug. 1969 15 p
(Contract DA-ARO(D)-31-124-G767)
(AD-692955) Avail: CFSTI CSCL 12/2

A program of research dealing with the mathematics of optimization is described. Particular emphasis was placed on the theory of games and on nonlinear programming. TAB

N70-12979# Lockheed Missiles and Space Co., Palo Alto, Calif.
VARIATIONAL PRINCIPLES AND GENERAL FORMULAS FOR THE MIXED PROBLEM OF THE WAVE EQUATION
L. Ainola 18 Apr. 1968 8 p refs Transl. into ENGLISH from Fiz. Mat., v. 18, no. 1, 1969 p 48-56
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The mixed problem for the wave equation in a time interval is formulated as a variational problem. By using differentiation and integration with respect to a parameter, two infinite sequences of functionals are derived from the appropriate functional for the considered problem. The variational principles found are used to derive general formulas, the reciprocity law, and a variant of the Green formula. Author

N70-13024# California Univ., Livermore. Lawrence Radiation Lab.
AN IMPLICIT DIFFERENCE SOLUTION OF MULTI-DIMENSIONAL HYDRODYNAMIC FLOW PROBLEMS
R. C. Schroeder and J. M. Thomsen 28 May 1969 18 p refs Submitted for publication Sponsored by AEC
(PB-185599; UCRL-71651) Avail: CFSTI CSCL 20D

Contents: difference schemes: the solution method; the solution of the simplified momentum equation; the equations for compressible Eulerian inviscid fluid motion USGRDR

N70-13027# Northeastern Univ., Boston, Mass.
A VARIATIONAL PRINCIPLE FOR NONHOLONOMIC SYSTEMS
Eugene J. Saletan and A. H. Cromer Oct. 1969 16 p refs Sponsored in part by NSF
(NUB-1971) Avail: Issuing Activity

The equations of motion for a Lagrangian system with velocity-dependent constraints, which cannot be obtained from the variational principle of Lagrange, are shown to follow a different variational procedure in which the comparison paths do not satisfy the constraint conditions. The new variational problem reduces to the Lagrange problem when the constraints are holonomic, and a new approach to Lagrange multipliers is introduced. Author

N70-13065# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND REGULATION THEORY
28 Oct. 1969 13 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 187, no. 6, 1969 p 1222-1224 and 1251-1253
(JPRS-49153) Avail: CFSTI

CONTENTS:

1. MATHEMATICAL DESCRIPTION OF COMPLEX SYSTEM ELEMENTS N. P. Buslenko et al p 1-5 refs (See N70-13066 03-19)

2. FREQUENCY AND TIME CHARACTERISTICS OF SYSTEMS WITH VARIABLE PARAMETERS V. A. Taft et al p 6-10 refs (See N70-13067 03-19)

N70-13066# Joint Publications Research Service, Washington, D.C.
MATHEMATICAL DESCRIPTION OF COMPLEX SYSTEM ELEMENTS
N. P. Buslenko et al *In its* Cybernetics and Regulating Theory 28 Oct. 1969 p 1-5 refs (See N70-13065 03-19)
Avail: CFSTI

A convenient scheme for simulating real complex systems consisting of elements of different classes is proposed. A description of the mathematical model, called an aggregate, requires consideration of the parametric families of terminating random processes and random flows, with symbols denoting these parameters written as arguments of the functions. The aggregate can receive input signals, send output signals, and at any point in time from the given interval it can be characterized by a specified internal state. Author

N70-13067# Joint Publications Research Service, Washington, D.C.
FREQUENCY AND TIME CHARACTERISTICS OF SYSTEMS WITH VARIABLE PARAMETERS
V. A. Taft et al *In its* Cybernetics and Regulating Theory 28 Oct. 1969 p 6-10 refs (See N70-13065 03-19)
Avail: CFSTI

A method for circumventing difficulties encountered when calculating infinite numerical determinants in systems with monotonically varying parameters is proposed. Where dependence of the parameters on time can be approximated by an infinite exponential series, a one-sided system can be considered, as opposed to a two-sided infinite system of equations. Definition of the pulse transition function, an important factor in systems with variable parameters, is also taken into account. A.C.R.

N70-13106# Scientific Translation Service, Ann Arbor, Mich.
ON CONTINUOUS FUNCTIONALS
Maurice Frechet 1969 26 p refs Transl. into ENGLISH from Ann. Ecole Norm., v. 27, no. 3, May 1910 p 193-216
(PB-186079T; ORNL-TR-2204) Avail: CFSTI CSCL 12A

Contents: series expansion of continuous functions by multiple integrals; the functionals of complete order; the analytic functional. USGRDR

N70-13107# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ON NORMS OF LINEAR POLYNOMIAL OPERATORS
S. A. Telyakovskii 15 Aug. 1969 18 p refs Transl. into ENGLISH from Matii. Sb., (Russia), v. 68(110), no. 4, 1965 p 561-569
(Contract NOw-62-0604-C)
(AD-693363; APL-CLB-3-T-591) Avail: CFSTI CSCL 12/1

Let C denote the space of all continuous periodic functions and let U sub n be a linear operator transforming every f epsilon C into some trigonometrical polynomial of degree n, U sub n (f,x) = 1/2 phi sub zero (f) + Summation, k = 1 to k = n, of the quantity (phi sub k (f) cos kx + psi sub k (f) sin kx), where phi sub k and psi sub k are certain linear functionals given in C and completely determining the operator U sub n. The paper gives an estimate of the norm of the arbitrary operator U sub n. TAB

N70-13122# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
SHOCK TESTING AND ANALYSIS: A NEW LABORATORY TECHNIQUE
J. Fagan and J. Sincavage *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 83-87 refs (See N70-13112 03-32)
Avail: CFSTI

Normally mechanical transients were specified as either a time history or as a shock spectrum. The analytical technique of dealing with transients is to obtain magnitude vs. frequency information by employing either the LaPlace or the Fourier transform. A data analysis technique was to artifically make a transient periodic and to analyze the resulting periodic signal. The periodic analysis can then be used or transformed to obtain the actual desired analysis of the transient. In order to perform shock testing, a reverse procedure is used whereby one period of a steady state signal is gated to a vibration system, thereby producing a transient having predictable and controllable characteristics that can be both generated and analyzed as a periodic occurrence. Author

N70-13127# British Steel Corp., London (England). Midland Group.
ELLIOTT 803 STATISTICAL PROGRAMS. PART 5: A COMPUTER PROGRAM TO CALCULATE EXACT CONFIDENCE LIMITS ABOUT A STRAIGHT LINE (PRS 13)
R. L. Middleton 1969 4 p
(PB-186295; M/PZ.004/S.5217/4/C) Avail: CFSTI CSCL 09B

The program described in the report has been developed as a natural extension of Part 1 of this series of general statistical programs 'A General Program for Multiple Regression Analysis'. It has been written to calculate the exact confidence limits about any straight line given the parameters relating to the equation, which can, if required, be obtained from output of a prediction equation from an analysis using the multiple regression program (PRS 11). Operating instructions together with details concerning preparation of data and steering tapes are also given. Author (USGRDR)

N70-13149# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FOCUSING IN THE NONLINEAR BRIEF WAVES APPLIED TO BALLISTIC SOUND [FOCALISATION DANS LES ONDES COURTES NON LINEAIRES APPLICATION AU BRUIT BALISTIQUE DE FOCALISATION]
Jean-Pierre Guiraud *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 13 p refs In FRENCH; ENGLISH summary
(See N70-13137 03-02)
Avail: CFSTI

The supersonic boom theory may be considered as an application of the non linear theory of short waves, and in the same way and without real more difficulty the focussing boom theory appears to be an application of the general theory of focussing phenomena in short waves. Author

N70-13171# Sandia Corp., Albuquerque, N. Mex.
A BASIC STATISTICAL APPROACH TO SYSTEM ACCURACY ANALYSIS

Malcolm H. Woodward Jul. 1969 28 p refs Sponsored by AEC
(PB-184915; SC-TM-68-810) Avail: CFSTI CSCL 12A

An approach to the problem of the system analysis is the accuracy study. Statistical results from an accuracy study can be presented in a basic standardized approach. This memorandum presents the statistical concepts necessary for the standardization and bridges the communication gap to set forth a simplified approach for future investigations. Author (USGRDR)

N70-13180# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SOME HISTORICAL REFLECTIONS TRACED THROUGH THE DEVELOPMENT OF THE USE OF FREQUENCY CURVES
Egon S. Pearson 3 Jul. 1969 27 p
(Contract N00014-68-A-0515)
(AD-693042; TR-38) Avail: CFSTI CSCL 12/1

The paper is mainly concerned with the uses made of Karl Pearsons system of frequency curves, in particular with developments originating in the Department of Statistics at University College London. After a brief account of the history of the Normal curve from the time of DeMoivre to Francis Galton, Pearsons derivation of his system of curves from a single differential equation is described. The system was originally intended for the gradation of observed frequency distributions which the Normal curve would not fit. But since Students pioneer work on the distributions of s squared, t and r (when rho = 0) the curves have been used again and again to approximate the sampling distributions of statistics whose moments only are known. They have also been used in Monte Carlo experiments to examine the distribution of statistics based on samples taken from representative non-normal populations The report illustrates some of this work and discusses conclusions to be drawn from it. Author (TAB)

N70-13196# RAND Corp., Santa Monica, Calif.
APPLICATION OF INVARIANT IMBEDDING TO THE EIGENVALUE PROBLEMS FOR BUCKLING OF COLUMNS
D. W. Alspaugh, H. H. Kagiwada, and R. Kalaba Aug. 1969 29 p refs
(Contract F44620-67-C-0045)
(AD-692696; RM-5954-PR) Avail: CFSTI CSCL 12/1

A classical eigenvalue problem for the buckling of beams is transformed into an initial-value problem by means of invariant imbedding. This initial-value form is particularly well suited for numerical integration. Several examples are presented to illustrate the technique and to demonstrate the accuracy of the numerical solution. Author (TAB)

N70-13197# British Steel Corp., London (England). Midland Group.
ELLIOT 803 STATISTICAL PROGRAMS. PART 8: SINGLE FACTOR ANALYSIS OF VARIANCE (PRS 21)
L. N. Tomlinson 1969 5 p refs
(PB-186171; M(U)PZ004/S5217/7/C) Avail: CFSTI CSCL 09B

This is another program in the present series of statistical programs. The program outputs an analysis of variance table and also a table of means sorted into ascending order of magnitude. Along side each mean is the variance of the group and the group number. Also included in the report are the operating instructions and a sample of the input and output. Author (USGRDR)

N70-13200# British Steel Corp., London (England). Midland Group.
ELLIOTT 803 STATISTICAL PROGRAMS. PART 2: A COMPUTER PROGRAM (PRS 9) TO CALCULATE AUTO AND CROSS-CORRELATION COEFFICIENTS AND ASSEMBLE LAGGED DATA TAPES
R. A. Houghton 1969 6 p refs
(PB-186292; PZ.004/S5217/1/C) Avail: CFSTI CSCL 09B

The computer program described in the report is one of a series of general statistical programs. The program has two functions: the calculation of correlation coefficients and standard deviations of two variables with lags and assembling of lagged data tapes from given data. Included in this report are operating instructions and samples of output. Author (USGRDR)

N70-13247# Royal Inst. of Tech., Stockholm (Sweden). Div. of Aeronautics.
DISCRETE CONTROL WITH POISSON DISTRIBUTED CONTROL ACTIONS
Fritz Hjalte May 1969 107 p refs
(PB-185724; KTH-AERO-TN-56) Avail: CFSTI CSCL 12A

The controller acts on a plant with a linear but otherwise arbitrary transfer function. It is shown that the ensemble mean values of the control system signals can be obtained from an equivalent continuous control system that can be treated with conventional transfer function methods. The difference between the discrete control system and its continuous equivalent can be quantitatively evaluated by means of the ensemble dispersion. Analytical expressions for the dispersion functions are given. This type of control may occur in situations where control precision is of minor importance and the controller's attention is interrupted by more vital tasks. Such a controller can be either a time shared information processing device or a distracted human controller in manual control. Author (USGRDR)

N70-13248# Stanford Univ., Calif. Inst. for Plasma Research.
FAST REVERSAL MAPPING FOR THE SOLUTION OF TWO-DIMENSIONAL OPERATORS
Roland Le Bail Jun. 1969 23 p
(Contract AT(04-3)-326)
(PB-185843; SU-IPR-314) Avail: CFSTI CSCL 12A

The paper shows that it is possible to transform an image by other operators than the Fourier transform or the Hadamard transform. The particularity of the transform depends on the extra condition imposed on it; it is used here to unscramble the 9 point finite form of the Poisson's equation in cylindrical geometry, but one can think of other purposes. Finally it is of interest to note that the total number of operations is 2M Log of M to the base 2 as for the Cooley Tuckey, but with rather fewer multiplications and more additions instead. Author (USGRDR)

N70-13255# Wisconsin Univ., Madison. Dept. of Statistics.
ON LACK OF FIT
Norman R. Draper and Agnes M. Herzberg Jun. 1969 19 p refs Prepared in cooperation with Imperial Coll. of Sic. and Technol
(Grant NSF GP-7842)
(PB-185723; TR-208) Avail: CFSTI CSCL 12A

Response surface designs are often used with a number of added center points. In such cases, when the basic design without center points is non-singular, a useful split of the lack of fit sum of squares can be effected: two general examples illustrate this, and some numerical illustrations are also provided. Author (USGRDR)

N70-13316# Illinois Univ., Urbana. Dept. of Computer Science.
CONSISTENT PROPERTIES OF COMPOSITE FORMATION UNDER A BINARY RELATION
John C. Schwebel and Bruce H. McCormick 12 Aug. 1969 50 p refs
(Contract AT(11-1)-1018)
(PB-186064; COO-1018-1189) Avail: CFSTI CSCL 12A

The paper describes the properties of a relation, H, between two sets, X and Y. H is included in $X \times Y$. We wish to determine when the existence of H between some elements of X and Y implies the existence of H between other composite elements of X and Y. The aim is to characterize a relation by its extension or restriction to composite elements. USGRDR

N70-13333# Bettis Atomic Power Lab., Pittsburgh, Pa.
WANSY: A PROGRAM TO SOLVE THE STATIC TWO-DIMENSIONAL GROUP DIFFUSION EQUATIONS BY SYNTHESIS METHODS
J. B. Yasinsky, J. W. Marinacci, and A. V. Vota Jul. 1969 54 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-891) Avail: CFSTI

WANSY is a synthesis program that combines one dimensional trial functions obtained from normal, adjoint or direct input WANDA solutions via axially dependent mixing coefficients to yield two-dimensional flux shapes. The trial functions may be axially discontinuous (different sets of trial functions may be used in different axial regions), and different numbers of trial functions may be used in different axial regions. The synthesis approximation may be group-dependent, partially or totally group-collapsed, and weight function scaling factors may be input to improve collapsed group synthesis solutions. The synthesis approximations and required input are described. Author (NSA)

N70-13354*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PSEUDONOISE SEQUENCE GENERATION WITH THREE-TAP LINEAR FEEDBACK SHIFT REGISTERS
Marvin Perlman 15 Nov. 1969 15 p refs
(Contract NAS7-100)
(NASA-CR-107212; JPL-TR-32-1432) Avail: CFSTI CSCL 12A

Linear recurring binary sequences with pseudonoise properties may be generated by shift registers with linear (logic) feedback. An r-stage linear FSR is characterized by an rth degree polynomial in one indeterminant, with coefficients taken from a field of two elements. The two-tap r-stage linear FSR characterized by an rth-degree primitive trinomial over GF(2) is the most efficient generator in terms of implementation of a PN sequence. Primitive trinomials do not exist, however, for every value of r. This paper deals with a search for rth-degree tetranomials through degree 34 which contain either an r-1th-degree or an $r-2$th-degree primitive polynomial over GF(2) as a factor. The tetranomials characterize a three-tap r-stage linear FSR capable of generating PN sequences when properly initialized. A primitive trinomial does not exist of degree $r-1$ equal to 8, 12, 13, 14, 16, 19, 24, 26, 27, 30, and 32. Tetranomials of degree r do exist, however, which contain as a factor a primitive polynomial of degree $r-1$ for each of the preceding values of $r-1$ except 12. Author

N70-13374# British Steel Corp., London (England). Midland Group
ELLIOTT 803 STATISTICAL PROGRAMS. PART 3: A PROGRAM TO FIT REGRESSION PREDICTION EQUATIONS (PRS 5)
R. E. Day 1969 8 p refs
(PB-186293; PZ.004/S.5217/2/C) Avail: CFSTI CSCL 09B

The program has been developed as a natural extension of Part I in this series A General Program for Multiple Regression Analysis. It has been written in such a form that the predictions equations resulting from analysis using Part I may be fitted using the same data tapes and preliminary arithmetic steering tape as Part I. Author (USGRDR)

N70-13410# Stanford Univ., Calif. Dept. of Operations Research.
MULTIPLE CHANNEL QUEUES IN HEAVY TRAFFIC. PART 2: SEQUENCES, NETWORKS, AND BATCHES
Donald L. Iglehart and Wart Whitt Jun. 1969 29 p refs
(Contracts N00014-67-A-0112; Nonr-225(53); Grant NSF GP-8790)
(AD-691271; TR-6; Pt-2; TR-122) Avail: CFSTI CSCL 12/2

Sequences of queueing facilities with r parallel arrival channels and s parallel service channels are studied under the conditions of heavy traffic: the associated sequences of traffic intensities approaching a limit greater than or equal to one. Weak convergence is obtained for sequences of random functions induced in D(0,1) by the basic queueing processes. Sequences of queueing systems in heavy traffic which are networks of the facilities described above are also investigated. Furthermore, customers are allowed to arrive and be served in batches. TAB

N70-13422# Illinois Univ., Urbana. Coordinated Science Lab.
PARAMETRIC EXPANSIONS OF OPTIMUM CONTROLS
J. B. Cruz, Jr., P. V. Kokotovic, and W. R. Perkins Sep. 1969 21 p refs
(Contracts DAAB07-67-C-0199; AF-AFOSR-1579-68)
(AD-693794; R-430) Avail: CFSTI CSCL 12/1

An approximation property of optimum controls is established, expressibly by Taylor series with respect to a parameter. It is shown that if an r-th order approximation is used instead of the exact optimum control, the optimum performance is approximated to order $(2r+1)$. Several applications of this result are made to the design of near-optimum large systems. Author (TAB)

N70-13499*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
FUNCTIONS AND DISTRIBUTIONS OF A SINGLE REAL VARIABLE. APPLICATIONS TO THE LAPLACE AND FOURIER TRANSFORMS [FONCTIONS ET DISTRIBUTIONS D'UNE SEULE VARIABLE REELLE. APPLICATIONS AUX TRANSFORMATIONS DE LAPLACE ET DE FOURIER]
Robert Legendre Washington NASA Nov. 1969 37 p Transl. into ENGLISH from ONERA Tech. Note No. 137
(Contract NASw-1692)
(NASA-TT-F-12567; ONERA-NT-137) Avail: CFSTI CSCL 12A

The aim of the study is to establish the essential properties of the functions of a real variable and of the distributions that generalize them, without recourse to the abstractions of functional spaces, but thanks to their linking to analytic functions of a complex variable. The Laplace and Fourier transforms are adapted to such a concept. Author

N70-13517# Manchester Univ. (England). Statistical Lab.
MULTIPLIERS ON LOCALLY COMPACT GROUPS Research Report
K. R. Parthasarathy Dec. 1968 55 p refs
(RR-10/KRP/1) Avail: CFSTI

In a previously proposed mathematical formulation of quantum mechanics the set of all propositions concerning a quantum mechanical system is an orthocomplemented lattice. The simplest example of such a lattice is one of all closed subspaces of a separable Hilbert space. The observables in such a system turn out to be self adjoint operators in the Hilbert space. In order to

construct the standard observables like energy, linear, angular, and spin angular momenta, etc., in such a system it is necessary to study the effect of coordinate transformations by a group G of symmetries. In this context the study of representations of G in the group of automorphisms of the given lattice is of great importance. In the systematic analysis of the multipliers on certain locally compact groups, a knowledge of Borel structures and measures in metric spaced and the basic theory of Lie groups is assumed. Author

N70-13541# California Univ., Berkeley. Operations Research Center.
CUTTING PLANE METHODS WITHOUT NESTED CONSTRAINT SETS
Donald M. Topkis Jun. 1969 24 p refs
(Contract Nonr-222-83; Grant NSF GP-8895)
(AD-694457; ORC-69-14) Avail: CFSTI CSCL 12/2

General conditions are given for the convergence of a class of cutting-plane algorithms without requiring that the constraint sets for the subproblems be sequentially nested. Conditions are given under which inactive constraints may be dropped after each subproblem. Procedures for generating cutting-planes include that of Kelley and a generalization of that used by Zoutendisk and Veinott. For algorithms with nested constraint sets, these conditions reduce to a special case of those of Zangwill for such problems and include as special cases the algorithms of Kelley and Veinott. An arithmetic convergence rate is given. Author (TAB)

N70-13552# Stanford Univ., Calif. Dept. of Computer Science.
THREE-STAGE VARIABLE-SHIFT ITERATIONS FOR THE SOLUTION OF POLYNOMIAL EQUATIONS WITH A POSTERIORI ERROR BOUNDS FOR THE ZEROS
Michael A. G. Jenkins Aug. 1969 206 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-67-A-0112)
(AD-694464; CS-138) Avail: CFSTI CSCL 12/1

Two new algorithms are introduced for solving polynomial equations and their implementation in ALGOL 60. An ALGOL 60 program is included for finding error bounds and improved approximations. The first zerofinding algorithm is a three-stage process for complex polynomials which is related to applying inverse iteration to the companion matrix. The three stages correspond to using inverse iteration with no shift, a fixed shift and a variable shift. A proof is included that the three stage algorithm always converges and that the third stage has a better than quadratic rate of convergence. The second zerofinding algorithm is a related three-stage process for real polynomials which finds either linear or quadratic factors. The bound program finds individual bounds with an option for improving the approximations. Numerical tests indicate that the amount of work done by the zerofinding program is almost independent of the configuration of the zeros. Author (TAB)

N70-13616# RAND Corp., Santa Monica, Calif.
PROBABILITY OF A PURE EQUILIBRIUM POINT IN N-PERSON GAMES
Melvin Dresher Oct. 1968 29 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-678040; RM-5768-PR) Avail: CFSTI CSCL 12/2

At random person noncooperative game, that game that prohibits communication and therefore coalitions among n players, is shown to have a pure strategy solution with a high probability. A solution of a game is an equilibrium point or set of strategies, one for each player, such that if n-1 players used their equilibrium strategies, then the n-th player has no reason to deviate from his equilibrium strategy. It is shown that the probability of a solution in pure strategies for large random games converges to $1 - 1/e$ for all n greater than or equal to 2. Author (TAB)

N70-13678# Syracuse Univ., N.Y. Dept. of Physics.
PHYSICAL INTERPRETATION OF COMPLEX ENERGY NEGATIVE METRIC THEORIES
A. M. Gleeson and E. C. G. Sudarshan Jul. 1969 44 p refs Supported by AEC
(SU-1206-200; NYO-3399-200) Avail: CFSTI

It has long been held that the divergences of field theory could be removed if the theory was formulated on a hilbert space with an indefinite metric. The difficulty of this approach was that the theory than possessed channels with negative probability and therefore violated unitarity. It was previously observed that this difficulty could be eliminated if negative metric states had complex energy. A model is produced which shows several of the difficulties associated with the Lee–Wick proposal. The existence of complex energies leads to interpretation difficulties and, in higher sectors, does not completely solve the unitarity problem. The model is used to show how the Lee–Wick conjecture can be extended to overcome the difficulties that are produced. The physical meaning of "good" theories with an indefinite metric are described. Author (NSA)

N70-13681# Los Alamos Scientific Lab., N. Mex.
NUMERIC SOLUTION OF THE FUNDAMENTAL MODE OF CYLINDRICALLY SYMMETRICAL RESONANT CAVITIES
Walter F. Rich and Martin D. J. MacRoberts 15 Jul. 1969 10 p refs
(Contract W-7405-eng-36)
(LA-4219) Avail: CFSTI

The numeric solution of the fundamental mode of cylindrically symmetrical resonant cavities is achieved with a FORTRAN program by using a double iterative process on the eigenvalue and eigenfunction. The primary input consists of the boundary of the figure, and the output consists of the three components of the electric and magnetic field that exist in this type of problem. Other output is possible, but is dependent upon the normalization of the field components. Author (NSA)

N70-13723# Manchester Univ. (England). Statistical Lab.
LIMITING DISTRIBUTION OF THE INTERVALS BETWEEN LOSSES WHEN THE INPUT IS RECURRENT AND THE SERVICE TIMES NEGATIVE EXPONENTIAL Research Report
D. G. Tambouratzis Sep. 1969 15 p refs
(RR-14/DGT/1) Avail: CFSTI

The aim of the present note is to give a simple proof that in a loss system of n servers with recurrent input and negative exponential service times the intervals between losses, suitable scaled to have constant means, tend to a negative exponential distribution as n tends to infinity. Also evaluated is the limit of the mean of the distribution of times n between losses and it is seen that in a system of infinitely many servers the time interval between a transition from $1-1$ to n busy servers and the first transition from n to $n+1$ busy servers after that has the limiting distribution of the intervals between losses in a loss system with n servers. Author

N70-13730# Air Force Systems Command, Wright-Patterson AFB, Ohio.
GENERAL BOUNDARY VALUE PROBLEMS FOR PARABOLIC SYSTEMS WITH INCREASING COEFFICIENTS
V. P. Lavrenchuk Jan. 1969 9 p refs Transl. into ENGLISH from Akad. Nauk URSR, Dopovidi Seriya a Fiziko Tekhnichni ta Matematichni Nauk (Kiev) v. 30, no. 3, 1968 p 238–243
(AD-694390; FTD-HT-23-807-68) Avail: CFSTI CSCL 12/1

The solution of a general boundary-value problem for Petrovsky parabolic systems with increasing coefficients is analyzed. For such a boundary value problem the Green matrix is constructed and its upper bound is established. The general form of the boundary value

problem solution is written in terms of the Green matrix and the problem of the permissible growth of the system coefficients, which ensure the existence of solutions in the same class of functions as for the boundary value problems for systems with bounded coefficients, is analyzed. In the case of a Dirichlet problem for second order systems with sufficiently smooth coefficients, the problem of extending the class of functions established above, in which solutions of the boundary-value problem exist, is analyzed under the assumption that the system is dissipative in the sense of Petrovsky. TAB

N70-13778# Illinois Univ., Urbana. Coordinated Science Lab.
AN EMBEDDING APPROACH FOR SOLVING RICCATI EQUATIONS
Gerald Charles T. Gh. D'ans Sep. 1969 59 p refs
(Contract DAAB07-67-C-0199; Grant AF-AFOSR-1579-68)
(AD-693909; R-428) Avail: CFSTI CSCL 12/1

The Riccati equation needs to be solved in the control theory and the estimation theory. Most frequently, this need arises in the state regulator and the Kalman – Bucy filter design. No anadytical solution of the Riccati equation has been found except in the one-dimensional case. For higher orders, one must use computer techniques to obtain a numerical solution. The conventional approaches fail to be satisfactory for many applications of reasonably high dimensions. The present work gives a way to avoid that kind of difficulty. Author (TAB)

N70-13791# California Univ., Los Angeles. Western Management Science Inst.
DUALITY IN NONLINEAR PROGRAMMING: A SIMPLIFIED APPLICATIONS-ORIENTED DEVELOPMENT
Arthur M. Geoffrion Aug. 1969 80 p refs *Its* Working Paper No. 150
(Grant NSF GP-8740; Proj. RAND)
(AD-694468) Avail: CFSTI CSCL 12/2

The number of applications of nonlinear duality theory, either computational or theoretical, is small by comparison with the number of theoretical contributions made to this subject over the last decade. This study attempts to rework and extend convex duality theory so as to diminish the existing obstacles to successful application. Consideration is given, for instance, to important but usually neglected questions concerning the computational solution of a program via its dual. A number of applications to the general theory of convex systems are indicated. The general approach taken is to exploit the powerful concept of a perturbation function. This permits simplified proofs (no conjugate functions or fixed point theorems are needed) and useful geometric and mathematical insights. Author (TAB)

N70-13802# Manchester Univ. (England). Statistical Lab.
INFINITELY DIVISIBLE REPRESENTATIONS AND POSITIVE DEFINITE FUNCTIONS ON A COMPACT GROUP
K. R. Parthasarathy Sep. 1969 15 p refs
(RR-13/KRP/3) Avail: CFSTI

The infinitely divisible positive definite functions on a compact group are described with applications for solving quantum field problems based on the notion of a continuous tensor product of Hilbert spaces. Author

N70-13803# Sheffield Univ. (England). Dept. of Probability and Statistics.
MINIMAX ESTIMATION OF SAMPLE SIZE
K. Dietz Jun. 1969 7 p refs
(RR-65/KD-2) Avail: CFSTI

A minimax estimator of the total number of individuals in a sample from a known population with distribution function equaled the quotient of the number of order statistics less than some fixed value. In earlier work, a situation was considered where the first order statistics were observed from a sample with a known distribution function in order to estimate the total number of individuals in the sample. A minimax estimator was derived using the methods of Dvoretzky, Kiefer, and Wolfowitz for processes with continuous time parameter. Author

N70-13805# Sandia Corp., Livermore, Calif.
AN EVALUATION OF THE USE OF THE FINITE ELEMENT METHOD IN THE COMPUTATION OF TEMPERATURE
A. F. Emery and W. W. Carson Aug. 1969 30 p refs
(Contract AT(29-1)-789)
(SCL-RR-69-83) Avail: CFSTI

A study is made of the accuracy and efficiency of the finite element method in comparison to the standard finite difference algorithms used for the computation of temperature. Numerical tests of linear, quadratic, and two cubic finite element models indicate that the quadratic model is the most accurate and desirable of these finite element models. It is demonstrated that for steady temperature distributions, with or without sources, the finite element models are superior to the finite difference method, but it also is shown that the finite element formulation may be used in forming a finite difference method which gives equal accuracy. However, the tests indicate that the normal finite difference method for transient problems which uses the Crank – Nicholson formulation is an order of magnitude faster in execution and requires an order of magnitude or more less machine core storage than the finite element method. It is generally concluded that if a well-documented and understood finite difference thermal analyzer is available, it is advisable to use it in its present form or at most to modify the conductances through the application of the quadratic finite element formulation. Author (NSA)

N70-13855# Illinois Univ., Urbana. Coordinated Science Lab.
SOME PROPERTIES OF A EULER GRAPH
S. Toida Sep. 1969 12 p refs
(Contract DAAB07-67-C-0199)
(AD-693793; R-427) Avail: CFSTI CSCL 12/1

Some properties of a Euler graph are found. It is shown that the number of distinct circuits containing an edge in a Euler graph is odd, that the number of paths between any two vertices in a Euler graph is even and that the number of edges in a cut -set in a Euler graph is even. Author (TAB)

N70-13917# Naval Ship Research and Development Center, Annapolis, Md.
SMALL SAMPLE ACCEPTANCE SAMPLING TABLES USING MEAN LIFE CRITERIA BASED ON THE WEIBULL DISTRIBUTION (INCLUDING THE EXPONENTIAL CASE)
Donald J. Fisk Aug. 1969 90 p refs
(AD-694471; Rept-3057; ATD-10) Avail: CFSTI CSCL 14/4

Acceptance criteria are established for mean life requirements, assuming that a Weibull failure time distribution, with shape parameter 0.6 = or < beta = or < 3.6, applies. This includes the exponential failure distribution as a special case (beta = 1), and when beta = 3.4, a close approximation to the normal distribution. Mean life is defined as the average time to failure of similar items operated under similar conditions. Acceptance sampling plans based on the binomial probability distribution have been developed for the mean life criterion, using sample sizes of 2 = or < n = or < 50, and acceptance numbers of zero = or < C = or < (n-1), c = or < 8, to assure, with minimum confidence of 90% and/or 95%, the acceptance of lots for which the estimated mean life is equal to or greater than some specified operating time. In addition to their use as acceptance sampling criteria, mean life estimates would also be appropriate for establishing correction factors to compare basic environmental test results, with those obtained under other than basic conditions. Author (TAB)

N70-13945# Sheffield Univ. (England). Dept. of Probability and Statistics.
PARAMETRIC ESTIMATION OF THE BASIS OF DISCRETIZED REALIZATIONS FROM A FINITE MARKOV CHAIN ON CONTINUOUS TIME
I. V. Basawa May 1969 17 p refs
(RR-62/IVB-3) Avail: CFSTI

Estimation of the single parameter, theta, is studied for the purpose of solving the transition probability functions on the basis of a discretized sample. Theta estimates are made when the observations are taken at fixed intervals, and at random intervals, of continuous time. The relative merits of three sampling designs are studied by comparing the asymptotic information contents of the discretized samples, even though such estimates are not directly comparable with those obtained from a continuous sample. When continuous inspection of a statistical process can not be made, a suitable discretized observational plan is justified; but even if a process can be observed continuously, a discretized sample may be chosen to advantage to simplify the estimation procedure. M.H.E.

N70-14007# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
SOME APPLICATIONS OF THE NOTION OF DUALITY IN THE RESEARCH OF SUPPORT FUNCTIONS OF THE SOLUTIONS OF LINEAR EQUATIONS [QUELQUES APPLICATIONS DE LA NOTION DE DUALITE A LA RECHERCHE DE FONCTIONS D'APPUI DE SOLUTIONS LINEAIRES]
Bernard Martinet Oct. 1969 28 p refs In FRENCH; ENGLISH summary
(CEA-R-3871) Avail: CFSTI

Given a linear equation containing a mapping in a Banach space, it is possible to define the set of solutions of this equation by using the duality concept. It is possible to solve convex optimization problems, and it appears that such duality problems are interesting intermediaries in theoretical existence studies and for investigating algorithms for finding approximate solutions. An example is discussed bearing on distribution moments. Author (ESRO)

N70-14010# Sheffield Univ. (England). Dept. of Probability and Statistics.
STOCHASTIC MODEL OF PNEUMOCONIOSIS PROGRESSION, PART 1
K. Kostal May 1969 29 p refs
(RR-64/KK-1) Avail: CFSTI

The assumption that the stochastic process is differentiable in quadratic mean is justified by the character of the variations in radiological abnormality of the lungs when simple pneumoconiosis develops. A system of first order differential equations is derived from this assumption. A partial differential equation is derived which includes the mean velocity of the continuous variation of radiological abnormality at a given instant and a given point of the abnormality scale. It is proved that the stochastic process representing the development of simple pneumoconiosis cannot be a simple Markov process. Results are generalized in the case where progression both of simple pneumoconiosis and from simple pneumoconiosis to progressive massive fibriosis are considered. Author

N70-14016# RAND Corp., Santa Monica, Calif.
THE DANTZIG-WOLFE DECOMPOSITION PRINCIPLE AND MINIMUM COST MULTICOMMODITY NETWORK FLOWS
Richard D. Wollmer Sep. 1969 12 p refs
(AD-693927; P-4191) Avail: CFSTI CSCL 12/2

J. A. Tomlin published a paper on meeting required multicommodity network flows at minimum cost. He formulated this problem in both node-arc and arc-chain form. The node-arc linear program was attacked by the Dantzig-Wolfe decomposition principle by expressing the derived master program as convex combinations of the extreme points of the derived subprograms. In this note, it is shown that this problem is really a special case of the problem where one is attempting to meet minimum cost multicommodity flows without flow requirements on the individual commodities. Tomlins algorithm is than modified to solve this more general problem. When this is done, the subprograms are homogeneous and the master program is a nonnegative combination of their independent solutions. Author (TAB)

N70-14044# Los Alamos Scientific Lab., N.Mex.
APPLICATION OF THE NELDER-MEAD SIMPLEX METHOD TO FINDING THE ZEROS OF POLYNOMIALS
Zane C. Motteler 27 Aug. 1969 43 p refs
(Contract W-7405-eng-36)
(LA-4228) Avail: CFSTI

The use of the Nelder - Mead simplex scheme (for minimizing functions of several variables) in determining the zeros of a polynomial by means of a systematic search of the complex plane is described. The results obtained from a code using this method are compared with those obtained from a previous code developed by the author, using a method of descent. Author (NSA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-12727# Wyoming Univ., Laramie.
ATMOSPHERIC WATER RESOURCES RESEARCH Final Report
Jun. 1969 71 p refs
(Contract DI-14-06-D-6002)
(PB-185888) Avail: CFSTI CSCL 04B

Systematic studies were conducted in which attempts were made to study: The environment of the cap cloud; the airflow of the cap cloud; the nucleation and growth of the cap cloud; the precipitation from the cap cloud; the development of the necessary instrumentation which is not readily available; and the application of the knowledge obtained for the beneficial development of water. Certain aspects of each of these areas has been investigated and the results of those investigations are presented. Of particular significance are the results concerning the airflow and nucleation and growth studies. The characteristics of a silver iodide plume from a ground based acetone generator have been parameterized. Numerical models have been utilized to predict the airflow. Cloud physics studies have described the ice crystal climatology and the ice, nuclei-ice crystal ratio of the cap cloud. Author (USGRDR)

N70-12824# National Research Council of Canada, Ottawa (Ontario). National Aeronautical Establishment.
STRATOSPHERIC TURBULENCE AND TEMPERATURE GRADIENTS MEASURED BY AN RB-57F: COLDSCAN FLIGHTS 2 TO 18
J. I. Mac Pherson and E. G. Morrissey (Meteorol. Service of Can.) Oct. 1969 55 p refs
(NRC-LR-527; NRC-11084) Avail: CFSTI

An instrumented USAF RB-57F weather reconnaissance aircraft for measuring turbulence and temperature gradients encountered on routine flights at altitudes from 40,000 feet to above 60,000

feet has accomplished 19 data flights covering 30,000 nautical miles of the central and western United States in a continuing program named Coldscan. This report summarizes the results of the first 19 flights and presents detailed accounts of a selection of 15 events showing large temperature changes or light to moderate turbulence. These presentations include time histories of the recorded variables, flight tracks showing event positions, and meteorological analyses. Data are presented on the correlation between the measured stratospheric turbulence and horizontal temperature gradients and on the geographical distribution of recorded incidents. Results of these winter and spring flights are most significant for the number of encounters with mountain waves, even at altitudes above 60,000 feet. Author

N70-12826# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

RESEARCH AND DEVELOPMENT TECHNIQUE FOR ESTIMATING AIRFLOW AND DIFFUSION PARAMETERS IN CONNECTION WITH THE ATMOSPHERIC WATER RESOURCES PROGRAM Final Report, 15 Mar. 1968 - 30 Jun. 1969

J. E. Cermak, L. O. Grant, and M. M. Orgill Aug. 1969 77 p refs

(Contract DI-14-06-D-6455)

(CER69-70JEC-LOG-MMO-11) Avail: CFSTI CSCL 04A

A stably stratified atmospheric boundary layer was simulated in a wind tunnel and utilized to determine radioactive kryton dispersion patterns over a 1:9600 scale model of the Eagle River Valley and topography surrounding Climax, Colorado. Geometric, dynamic, and thermal similarity are considered, primarily, for barostromatic airflow. Similarity criteria for transport and dispersion are considered also. The barostromatic airflow model indicated that topography plays an important role in determining the downwind direction of the particulate plume. Author (USGRDR)

N70-12866# National Environmental Satellite Center, Washington, D.C.

THE IMPROVEMENT OF CLEAR COLUMN RADIANCE DETERMINATION WITH A SUPPLEMENTARY 3.8 MICROMETER WINDOW CHANNEL

William L. Smith Jul. 1969 24 p refs

(PB-185065; ESSA-TM-NESCTM-16) Avail: CFSTI CSCL 04B

Under cloudy conditions relatively large errors in calculated clear column radiances for infrared temperature profile radiometer (ITPR) scan elements can arise where the cloud height is highly variable and where the cloud emissivity varies with wavelength. A method for detecting such cloud conditions using supplementary 3.8 micron window observations was developed and tested using ITPR observations deduced from Nimbus 2 high resolution infrared radiometer data. The clear cloud radiances derived with the aid of these observations are more precise than those calculated without this supplementary data. It appears possible to obtain more accurate radiances for smaller areas and in regions of extremely high (but less than 100%) cloud cover. This knowledge should enable more accurate temperature soundings, down to the earth's surface, to be derived close to the centers of weather activity. Author (USGRDR)

N70-12867# Atmospheric Sciences Library, Silver Spring, Md.

AN ANNOTATED BIBLIOGRAPHY ON METHODS OF CLOUD-HEIGHT MEASUREMENT, 1950-1968

Annie E. Grimes Apr. 1969 51 p refs

(PB-185110) Avail: CFSTI CSCL 04B

The bibliography on the methods of cloud-height measurement for 1950-1968 was compiled from sources in the Atmospheric Sciences Library and the Library of Congress. Author (USGRDR)

N70-12874+ Freie Univ., Berlin (West Germany). Inst. Fuer Meteorologie Und Geophysik.

METEOROLOGICAL TRANSACTIONS. DAILY TERRAIN AND 850 MB MAPS OF THE NORTHERN HEMISPHERE, 1969, VOLUME 102, NO. 2 [METEOROLOGISCHE ABHANDLUNGEN. TAEGLICHE BODEN UND 850 MB KARTEN DER NORDHEMISPHAERE IN JAHRE 1969, BAND 102, HEFT 2]

Manfred Geb and Richard Scherhag 1969 370 p In GERMAN

Avail: CFSTI

Meteorological charts are presented for 00 and 1200 GMT for the period 1 April 1969 through 30 June 1969. N.E.N.

N70-12949# Weather Bureau, Silver Spring, Md. Techniques Development Lab.

A COMPARISON OF TWO METHODS OF REDUCING TRUNCATION ERROR

Robert J. Bermowitz May 1969 12 p refs

(PB-184741; ESSA-WBTM-TDL-20) Avail: CFSTI CSCL 04B

The comparative reduction of truncation error by shrinking the space scale and using a higher order approximation of the derivative is examined. It is found that for wavelengths less than about 2000 km., use of the second order approximation with a grid interval of 190.5 km. results in a greater reduction of truncation error than a fourth order approximation with a grid interval of 381 km. Two fourth order approximations are also compared and found to give similar results. Considering the effects of truncation error alone, it is inferred that the shortest wavelength whose movement can be predicted with about 90% accuracy, with use of a fourth order approximation, is approximately 4.5 times the grid interval being used in the computations. Author (USGRDR)

N70-12950# Weather Bureau, Silver Spring, Md. Operations Support Div.

PROBABILITY OF TROPICAL CYCLONE INDUCED WINDS AT CAPE KENNEDY

John R. Hope Jun. 1968 71 p refs Presented at the 5th Space Congr., Cocoa Beach, Florida, 11-14 Mar. 1968

(PB-184717; ESSA-WBTM-SOS-1) Avail: CFSTI CSCL 04B

A statistical technique is developed for estimating the climatological probability that an existing tropical cyclone will produce sustained 35-knot winds at Cape Kennedy. Probabilities are computed for specific times and for various time intervals extending to seven days. The technique is developed initially considering only the storm's location, then expanded to take into account its antecedent path. Two classes of storms are processed separately: (1) Those originating over the Atlantic Ocean or the eastern Caribbean Sea, and (2) those originating over the western Caribbean Sea or the Gulf of Mexico. The technique can be adapted for wind speeds of other threshold values and for other coastal locations which may be affected by tropical cyclones. Author (USGRDR)

N70-12951# RAND Corp., Santa Monica, Calif.

WEATHER-MODIFICATION PROGRESS AND THE NEED FOR INTERACTIVE RESEARCH

Oct. 1968 94 p refs

(Contract NSF C-415)

(PB-184710; RM-5835-NSF) Avail: CFSTI CSCL 04B

A review of the status of weather modification research is given, with emphasis on progress since 1966. The authors stress that (1) the possibility of inadvertent weather or climate modification is rapidly becoming a probability, as human effects on the atmosphere and the surface of the planet grow at an increasing rate; (2) progress in weather modification research continues to be hampered by the prevalent lack of cohesive effort by both theoreticians and experimenters; (3) computers of advanced design and increased capacity will handle atmospheric models of considerably greater sophistication than in the past; and (4) this is a

not-to-be-neglected opportunity for interactive research – constant two-way feedback from theory to experiment to theory, with dynamic atmospheric models facilitating each advance. Author (USGRDR)

N70-12989# Allied Research Associates, Inc., Concord, Mass.
MEAN AND VARIANCE OF HAIL FALL SPEED
Raymond Wexler Aug. 1969 26 p refs
(Contract F19628-67-C-0117)
(AD-693216; AFCRL-69-0341; Rept-9G42-11; SR-1) Avail: CFSTI CSCL 4/2

The mean and the variance of the Doppler velocity of distributions of hail sizes are computed for wavelengths of 3.2, 5.4 and 10.7 cm diameter. Hail which has melted by the time it reaches the ground may have a diameter as large as 1 cm at the OC level (near 4 km), and the mean Doppler fall speed at the level is about 15 m/sec with a variance of 2 to 4 sq m/sq/sec. With larger hail the mean fall speed and the variance may be appreciably higher. The effects of hail melting, growth, and sorting by wind shear are evaluated in order to aid in the interpretation as to the existence of strong vertical motions, hail, and turbulence in storms observed by vertically directed Doppler radar. Author (TAB)

N70-12986# Sandia Corp., Albuquerque, N.Mex.
OBSERVATIONS OF ATMOSPHERIC DENSITY, TEMPERATURE, AND WINDS OVER KAUAI
Lawrence B. Smith Aug. 1969 91 p refs
(SC-RR-68-523) Avail: CFSTI

Neutral atmospheric density and temperature data between 30 and 110 km and wind measurements between 30 and 70 km as obtained from 15 falling sphere experiments are presented. Twelve experiments were made over Kauai, Hawaii, two were made over Tonopah Test Range, Nevada, and one over Johnston Atoll. During some of the sphere experiments rocketsonde and radiosonde data were obtained which are also presented. Comparisons are made with similar measurements at low latitudes and with standard atmospheres. A definite seasonal difference is shown above 80 km, with densities higher in winter than in summer or standard. Wintertime temperatures are 10 to 15 degrees K warmer in the mesopause region than in summer or in the standards. A 6 hour change in temperature of 20 degrees K between 67 and 87 km was also observed. Recommendations for additional experiments needed to define more exactly the atmospheric background and its variations in the 30 to 110 km region over Kauai are presented. Author (NSA)

N70-13001# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
INCREASING WATER SUPPLIES FOR THE NORTHERN GREAT PLAINS THROUGH CLOUD MODIFICATION Final Report
A. S. Dennis, B. L. Davis, J. A. Donnan, H. D. Orville, and P. L. Smith, Jr. Jul. 1969 92 p refs
(Contract DI-14-06-D-5979)
(PB-186116; Rept-69-12) Avail: CFSTI CSCL 04B

The report describes a program of theoretical, laboratory and field experiments directed toward increasing usable water supplies for the northern Great Plains through weather modification. Significant results described include the documentation of changes in rainfall associated with cloud seeding, the development of radar facilities including an on-line computer to support field experiments, the construction of a wind tunnel/cloud chamber facility for testing seeding devices, and the development of a numerical model of cumulus clouds forming over a heated mountain ridge. Author (USGRDR)

N70-13002# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
AN OPERATIONALLY ORIENTED OBJECTIVE ANALYSIS PROGRAM
Harry R. Glahn, George W. Hollenbaugh, and Dale A. Lowry Jul. 1969 26 p refs
(PB-186-129; ESSA-TM-WBTM-TDL-22) Avail: CFSTI CSCL 04B

A computer program which performs objective analyses of sea level pressure and saturation deficit by the method of successive approximations is described. The program was designed to be run operationally and includes error detecting routines. Analyses of hourly airways data collected on magnetic tape are made on a 39 × 40 grid over the eastern and central U.S. The small scale detail specified by the relatively dense observations is retained with a grid length of about 50 miles. Details of the error detecting, correction, and smoothing procedures are described. A listing of the program is included. Author (USGRDR)

N70-13032# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 213 1 Oct. 1969 p 17–22 refs (See N70-13030 03-13)
Avail: CFSTI

Publication of a book on the characteristics of tropospheric, planetary, high-level frontal zones and jet streams in the northern hemisphere as related to seasons and types of macrosynoptic processes is reported. The opening of an international conference on cloud physics and artificial cloud modification is also mentioned, and a description is given of a high altitude geophysical institute with facilities for investigating meteorological phenomena and the physical properties of avalanches and glaciers, as well as provisions for actinometric studies. Selected abstracts on atmospheric characteristics of various geographic areas and meteorological phenomena are also included. A.C.R.

N70-13061# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Mathematical Statistics.
FIRST OCCURRENCE TIME OF 8 CONSECUTIVE DRY MONTHS IN QUEENSLAND
A. M. W. Verhagen and F. Hirst 1969 11 p refs *Its* Tech. Paper No. 29
(PB-186182) Avail: CFSTI CSCL 04B

Sequences of wet and dry months are regarded as realizations of independent binomial trials with probabilities z sub 1,...,z sub 12 that the calendar months are wet (a success). It is shown that for this or any periodicity in the probabilities of success the distribution of the first occurrence times of a specified number delta of consecutive failures may be characterized by recurrence relations between successive terms of the distribution. The recurrence relations and the bounds are applied to compute means and standard deviations of the distribution of first occurrence times for 42 localities in Queensland, for various specified values of delta, taking the beginning of the calendar year as the starting point in time. USGRDR

N70-13110# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 34: ROCHESTER, NEW YORK, ROCHESTER-MONROE COUNTY AIRPORT
Jun. 1969 33 p refs
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-34) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Rochester, N.Y., airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation at the air terminal. Author

N70-13111# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW ... MILE AND CEILINGS BELOW 200 FEET. VOLUME 35: ST. LOUIS, MISSOURI, LAMBERT-ST. LOUIS MUNICIPAL AIRPORT
Jun. 1969 33 p refs
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-35) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Saint Louis airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation at the air terminals. Author

N70-13175# Weather Science, Inc., Norman, Okla.
SUPERPRESSURE BALLOON-TRANSPONDER SYSTEMS. PART 1: A SUMMARY OF THREE YEARS USE IN THUNDERSTORM RESEARCH Final Report
Hoyt E. Hart, Dale C. Hall, and Joe L. Sutherland 15 Jun. 1969 79 p refs
(Contract ESSA-E22-65-69(N))
(PB-184959; WSI-WR903-PT-1) Avail: CFSTI CSCL 04B

The research involved the improvement of current, and production of new, computer programs designed to evaluate all possible meterological variables within the scope of the information telemetered from the transponders and acquired from the radar track data. Following this, Weather Science meteorologists studied the meso- and micro-scale circulations in and around selected storm cells in some detail. Balloon tracks were reevaluated in relation to these cells on the basis of available radar data provided by the National Severe Storms Laboratory. USGRDR

N70-13176# New Mexico State Univ., Las Cruces. Engineering Experiment Station.
ATMOSPHERIC WATER RESOURCES RESEARCH IN THE STATE OF NEW MEXICO Final Report, Feb. 1967 - Jun. 1969
Jesse V. Lunsford, Conrad G. Keyes, Jr., Jim Seckler, and Fred Stover Jul. 1969 158 p refs
(Contract DI-14-06-D-6146)
(PB-186115; TR-51) Avail: CFSTI CSCL 04B

During the period 1 February 1967 to 30 June 1969 scientific studies were conducted within the Jemez-Sierra Nacimiento Mountains to determine: (1) the type and frequency of major storm systems that cause winter precipitation; (2) the meteorological parameters associated with the storm systems; (3) the criteria for a seedable unit, (4) the diffusion processes of artificial nucleants; (5) the number and location of precipitation stations, snow courses, snow boards and snow poles; (6) the analysis procedures for significance of data; and (7) the utilization of knowledge obtained to enhance precipitation augmentation and management techniques. Specific components of these studies have been researched and the significant results are presented. USGRDR

N70-13182 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL TRANSACTIONS. CLIMATOLOGICAL MAPS OF THE NORTHERN HEMISPHERE, VOLUME 100, NO. 1 [METEOROLOGISCHE ABHANDLUNGEN. KLIMATOLOGISCHE KARTEN DER NORDHEMISPHAERE, BAND 100, HEFT 1]
Richard Scherhag 1969 232 p In GERMAN; ENGLISH summary
Avail: CFSTI

The mean northern hemispheric climatological maps contained in this volume comprise the pressure at sea level, the 850, 700, 500, 300, and 200 mb maps, mean values of temperature, relative humidity; precipitation is being supplemented by 26 maps containing the monthly highest and lowest values. Furthermore, mean 50 mb maps were added. The 100 mb charts also contain mean vector winds over the United States derived from the monthly means published by the US climatological data center. Author

N70-13183+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL TRANSACTIONS. FINDINGS OF THE SYNOPTIC SERVICE, 1969: DAILY WEATHER MAPS, VOLUME 101, NO. 6 [METEOROLOGISCHE ABHANDLUNGEN. ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1969: TAGLICHE WETTERKARTEN, BAND 101, HEFT 6
Richard Scherhag Jun. 1969 165 p In GERMAN
Avail: CFSTI

The synoptic weather service of the Berlin university presents daily weather charts for June, 1969, of the Northern Hemisphere at ground, 500 mb, and 300 mb levels. Brief studies on weather prediction, geopotential reduction methods, and the climatology of the Bretagne are included. Transl. by G.G.

N70-13184# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENT IN NUMERICAL PREDICTION IN EQUATORIAL LATITUDES
T. N. Krishnamurti Oct. 1968 77 p
(Grants AF-MIPR-ES-7-967; NSF GA-1480)
(AD-678080; SR-4) Avail: CFSTI CSCL 4/2

A complete initial state is constructed using a consistent balance system of equations. The procedure involves construction of pressure, temperature and vertical motion distributions starting from an observed rotational part of the wind field. It is shown that this procedure, whose validity assumes a small Rossby number, does not yield a realistic structure of the vertical motion. A short range prediction with a multi-level prediction model yields some interesting solutions in the vicinity of the intertropical convergence zone. During the first 18 hours of prediction an adjustment of the motion and the mass field ensues with gravity inertia oscillations. A detailed discussion of some dynamical aspects at 24 hours is presented. An important feature of the model is a parameterization of cumulus convection as a function of large-scale moisture convergence. The role of cumulus scale heating in the vicinity of the intertropical convergence zone is explored by carrying out experiments with and without diabatic heating. Author (TAB)

N70-13192# Akron Univ., Ohio. Dept. of Electrical Engineering.
STUDY OF THE VARIATION OF THE WIND GUST FACTOR
P. O. Huss Nov. 1968 91 p refs
(Grant ESSA-E158-67(G))
(PB-184787; R3) Avail: CFSTI CSCL 13M

This report is the third of a series devoted to the study of the wind gust factor with the prime objective of furnishing guide lines to engineers who wish to have some design information about maximum wind speeds that might be encountered by a structure. The study has been based upon open scale wind recordings taken near Akron, Ohio and two storms recorded near Ann Arbor, Michigan. Author (USGRDR)

N70-13195+ Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL TRANSACTIONS. FINDINGS OF THE SYNOPTIC SERVICE, 1969: DAILY WEATHER MAPS, VOLUME 101, NO. 5 [METEOROLOGISCHE ABHANDLUNGEN. ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1969: TAGLICHE WETTERKARTEN, BAND 101, HEFT 5
Richard Scherhag May 1969 192 p In GERMAN
Avail: CFSTI

Presented are daily synoptic weather maps of the Northern Hemisphere as obtained by the Berlin Meteorological Institute during May, 1969. Measured were ground, 500 mb, and 300 mb levels. Also included are brief studies on the kinematics of atmospheric lee waves, weather predictions, cloud cover seeding for precipitation, and meterological and geophysical measurements obtained onboard ships. Transl. by G.G.

N70-13198# Environmental Data Service, Silver Spring, Md.
BIBLIOGRAPHY OF WEATHER AND ARCHITECTURE
John F. Griffiths and M. Joan Griffiths May 1969 78 p refs
(PB-184969; EDSTM-9) Avail: CFSTI CSCL 04B

Contents: Corrosion and weathering; heat balance and temperature; illumination; precipitation, radiation, siting aspects, soil frost, ice and snow; tropics; wind. USGRDR

N70-13281# National Hurricane Research Lab., Miami, Fla.
EXPERIMENTS WITH A NUMERICAL MODEL OF TROPICAL CYCLONE DEVELOPMENT. SOME EFFECTS OF RADIAL RESOLUTION
Stanley I. Rosenthal Aug. 1969 51 p refs
(PB-185965; ESSA-ERLTM-NHRL-87) Avail: CFSTI CSCL 04B

Experiments with 10-km and 20-km radial resolution are compared. The 10-km calculation yields a storm with more realistic structure. The 20-km case does not contain a well-defined eye, whereas the 10-km experiment does. Rainfall,kinetic energy production, and efficiency are all larger with 20-km resolution. In both experiments, computational damping is an important component of the kinetic energy budget; however, the total dissipation of kinetic energy (computational plus explicit) is fairly reasonable in comparison to that found in empirical studies. This result provides an estimate of the eddy viscosity coefficients, which would be needed to obtain realistic results with a nondissipative numerical model. Author (USGRDR)

N70-13284# Weather Bureau, Washington, D.C. Office of Hydrology.
ELEMENTS OF RIVER FORECASTING
Marshall M. Richards and Joseph A. Strahl Mar. 1969 64 p refs Revised
(PB-185969; ESSA-WBTM-HYDRO-9-Rev) Avail: CFSTI CSCL 04B

The flow of a river fluctuates through a considerable range on an annual basis. It is characterized by rises, due to runoff from rainfall and snowmelt, followed by gradually receding flow. Flood forecasts are primarily concerned with predicting the time and height of stages caused by peak flows. This paper is chiefly concerned with forecasting storm hydrographs with emphasis on the crests. There are three major steps to forecasting the rise that results from a rainstorm or period of heavy snowmelt: Estimating the volume of water that will run directly off the land surface into the stream. Forecasting the distribution of this volume of water with time as it passes a forecast point. Forecasting the change in shape of the floodwave as it moves downstream. This is known as streamflow routing. Author (USGRDR)

N70-13286# Weather Bureau, Silver Spring, Md. Data Acquisition Div.
REQUIREMENTS STATEMENTS FOR SELECTED DATA ACQUISITION EQUIPMENT
James Giraytys and Paul L. Hexter Jul. 1969 93 p ref
(PB-185231; ESSA-TM-WBTM-DATAC-3) Avail: CFSTI CSCL 04B

The purpose of the document is to set forth a detailed statement of requirements for an improved upper-air sounding system which will replace the current system. Only requirements for the improved upper-air system are considered. The requirements used in this document are based primarily on the needs of synoptic meteorology (including severe storm forecasting) and aviation. Author (USGRDR)

N70-13287# Weather Bureau, Salt Lake City, Utah. Western Region.
MAN-MACHINE MIX IN APPLIED WEATHER FORECASTING IN THE 1970's
Leonard W. Snellman Aug. 1969 25 p refs
(PB-185068; ESSA-TM-WBTM-WR-40) Avail: CFSTI CSCL 04B

Significant improvement in some phases of operational forecasting over the past several years is demonstrated and is attributed to the transition from a totally manual to a man-machine -mix operation. The man-machine mix has been replaced by a machine product only if the quality of this end product is comparable or better than the man-machine mix product. The conclusion is reached that while most centrally prepared forecase guidance for field forecasters may soon be a purely machine product, man will provide an important input into improved weather services in the preparation of short period general public forecasts, specialized user forecasts, and warnings. Atmospheric predictability studies and the lack of success of machine aviation terminal forecasting are discussed. Author (USGRDR)

N70-13288# National Environmental Satellite Center, Washington, D.C.
DERIVING UPPER TROPOSPHERIC WINDS BY COMPUTER FROM SINGLE IMAGE DIGITAL SATELLITE DATA
Charles S. Novak Jun. 1969 38 p refs
(PB-185086; ESSA-TM-NESCTM-13) Avail: CFSTI CSCL 04B

An evolving method for extracting wind information from satellite cloud picture data by computer is described. The basic data are the analog signals used to transmit the cloud pictures from the satellite to the ground. These signals are digitized, and the data are Mercator mapped on disk space in the computer. The described procedures operate on the data from the disk or from digital tapes produced from the disk. Wind directions are obtained by applying a center of gravity algorithm to successive binary slices through cumulonimbus cloud systems. Wind speed estimates are derived through double mass curve analyses and slope comparisons of cloud areas. These algorithms have been successfully applied to preselected cumulonimbus clouds. Author (USGRDR)

N70-13303# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
STUDIES ON INTERACTION BETWEEN SYNOPTIC AND MESOSCALE WEATHER ELEMENTS IN THE TROPICS
Herbert Riehl and Robert P. Pearce (Imperial College of London, England) Jun. 1968 69 p refs *Its* Atmospheric Sci. Paper No. 126
(Grant ESSA E22-138-67(G))
(PB-185718; Rept-1) Avail: CFSTI CSCL 04B

Contents: Some Aspects of Cumulus-Scale Downdrafts; Vorticity Budgets Derived from Caribbean Data. USGRDR

N70-13331# Weather Bureau, Fort Worth, Tex. Southern Region Headquarters.
DISTURBANCES IN THE TROPICAL AND EQUATORIAL ATLANTIC
R. H. Simpson Jun. 1969 30 p refs
(PB-184740; ESSA-TM-WBTM-SR-47) Avail: CFSTI CSCL 04B

The National Hurricane Center and the WMO Regional Center for Tropical Meteorology, co-located at Miami are trying to make effective use of the meteorological satellite in the detection, tracking, and classification of disturbances in the tropical and equatorial Atlantic. To accomplish this without prejudicing the results it has been necessary to redefine analysis models and disturbance types, mainly to generalize the description of circulations which support disturbances. The purpose here is to define or describe analysis models used at the National Hurricane Center and present some examples of disturbances which are being studied. A census of the Atlantic disturbances which were identified and tracked by the Regional Center in 1968 are presented and compared with the census for 1967. Author (USGRDR)

N70-13340# Arctic Inst. of North America, Washington, D.C.
A STUDY OF TECHNOLOGIES FOR REDUCING WINTER WEATHER COSTS
Jun. 1969 143 p refs Sponsored by Office of Regional Develop.
(PB-185658; RP-55) Avail: CFSTI CSCL 05C

The Arctic Institute of North America has examined a variety of facts available to it pertaining to the effects of winter weather on regional development of the northern New England states and the states of upper Great Lakes. Author (USGRDR)

N70-13344# Minnesota Univ., Minneapolis. Dept. of Aeronautics and Engineering Mechanics.
THEORETICAL RESEARCH IN KINETIC THEORY AND RAREFIED GASDYNAMICS Final Technical Report, 16 Dec. 1964 - 15 Dec. 1968
Thomas S. Lundgren 15 Dec. 1968 4 p refs
(Contract AF 33(615)-2341)
(AD-678194; AFOSR-68-2493) Avail: CFSTI CSCL 20/4

Research activity has been concentrated in three main problem areas. The first is the study of shock wave structure. The second is an approach to nonhomogenious turbulence, using kinetic theory methods. The third problem area is magnetohydrodynamic channel flow. Author (TAB)

N70-13347# Weather Science, Inc., Norman, Okla.
SUPERPRESSURE BALLOON-TRANSPONDER SYSTEMS. PART 2: A SUMMARY OF THREE YEARS USE IN THUNDERSTORM RESEARCH Final Report
Hoyt E. Hart, Dale C. Hall, and Joe L. Sutherland 15 Jun. 1969 550 p refs
(Contract ESSA E22-65-69(N))
(PB-185826; WSI-WR903-PT-2) Avail: CFSTI CSCL 04B

The report presents computer printouts tables on thunderstorm development with use of superpressure ballons with radar equipment. USGRDR

N70-13360# Illinois State Water Survey, Urbana.
EVALUATION OF PRECIPITATION MODIFICATION EXPERIMENTS FROM PRECIPITATION RATE MEASUREMENTS
F. A. Huff, W. L. Shipp, and P. T. Schickedanz 30 Apr. 1969 129 p refs
(Contract DI-14-06-D-6575)
(PB-186117) Avail: CFSTI CSCL 04B

An investigation of the natural time and space characteristics of 1-minute rainfall rates in warm season storms of the Midwest was made. The potential applicability of rate distributions in the verification of cloud seeding effects was evaluated from the analytical results within the limits permitted by the statistical sample. Attention was given to the effects of rain type, synoptic storm type, and other meteorological parameters on the time-space distributions. Time characteristics were defined primarily through the development of storm time distribution models, calculation of sequential variability, and determination of lag correlation relations. Spatial distribution characteristics were based largely upon studies of area-depth relations, spatial correlation patterns, and relative variability calculations. Author (USGRDR)

N70-13367# California Univ., Berkeley. Vehicle Technology Facility.
FOG ACCIDENT PREVENTION STUDY: VISIBILITY OF COLORED LUMINOUS AREAS IN FOG Final Report
Apr. 1969 35 p refs Prepared in cooperation with Bur. of Public Roads
(PB-185035) Avail: CFSTI CSCL 13L

A series of subjective visibility tests, performed with luminous-area, red-light sources of different sizes in artificially generated fog, show that in daytime fog of 50-ft visual range and nighttime fog of 100-ft visual range, there was no appreciable difference in visibility between 2-in.-diameter and 6-in.-diameter sources of equal intensities. In nighttime fog of 500-ft visual range, the larger source was found to be somewhat more visible than the smaller one. Another series of subjective tests was performed under various visibility conditions to determine the visual detection constrasts for red, amber and green luminous area targets viewed against correspondingly colored backgrounds. The results show that under clear-weather conditions, daytime or nighttime, there was no appreciable difference in target-to-background detection contrast for the three colors. Author (USGRDR)

N70-13368# McGill Univ., Montreal (Quebec). Stormy Weather Group.
ROTATING-LENS STEREO CLOUD PHOTOGRAPHY
R. W. Shaw Jul. 1969 16 p refs
(Contract ESSA E22-14-69(N))
(PB-186357; SR-MW-62) Avail: CFSTI CSCL 04B

Rotating-lens cameras, with field 140 deg. × 55 deg. have been used (and are in use) for stereoscopic photography of clouds. Each picture has the horizon half way up; the landscape in the bottom half provides fiducial marks, while the top half is a sky picture 140 deg. (linear in azimuth) × 27 deg. (linear in tangent of elevation, or height/range). These position parameters (angle in the horizontal, tangent in the vertical) are the ones actually used in stereoscopic work; they are measured easily by projection onto a rectangular grid. With base line 9.5 miles, uncertainties in range and height of recorded cloud features are roughly plus or minus 2% at 20 nmi, plus or minus 5% at 50 nmi and plus or minus 8% at 80 nmi. Author (USGRDR)

N70-13403# Joint Publications Research Service, Washington, D.C.
TRENDS IN METEOROLOGICAL RESEARCH OUTLINED
Frigyes Desi *In its* Transl. on Eastern Europe: Sci. Affairs No. 83 7 Nov. 1969 p 13-25 Transl. into ENGLISH from Magy. Tud. (Budapest), Jul.-Aug. 1969 p 426-435 (See N70-13402 03-34)
Avail: CFSTI

Advocated is the use of modern devices, such as satellites, computers, and global network stations for worldwide research on atmospheric processes. A uniform system of observation devices and synchronization of observational methods will insure the international synthesis of weather patterns. G.G.

N70-13414# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 215 30 Oct. 1969 p 7-17 refs (See N70-13412 03-13)
Avail: CFSTI

Continuing meteorological research is briefly reported. Atmospheric contamination, ozone and water vapor content, and aerosols were studied. The Siberian maximum atmospheric pressure and the jet stream over Moscow are described. Data on the wind and temperature distribution in the Antarctic stratosphere are summarized, and the use of helioclimatic relationships in long range forecasting is mentioned. Improvements in photometric techniques and measurement errors of particle counters are covered. N.E.N.

N70-13426# Weather Bureau, Kansas City, Mo.
SEASONAL ASPECTS OF PROBABILITY FORECASTS. PART 1: SUMMER
Lawrence A. Hughes Jun. 1968 22 p
(PB-185733; ESSA-TM-WBTM-CR-22) Avail: CFSTI CSCL 04B

Probability forecasts of measurable precipitation in 12- and 6-hour periods have been made by stations in the Central Region from September 1965 to date. The early months of this effort were experimental ones in that a considerable learning effort was needed on the part of forecasters to adapt their forecasting to the precision of the probability statement. Author (USGRDR)

N70-13438# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN ANALYSIS OF LABORATORY METHODS OF MEASURING SCATTERING PARAMETERS WHICH CHARACTERIZE OBSCURATION EFFECTS OF AEROSOLS
Preston F. Gott and Alan R. Downs Aug. 1969 42 p refs
(AD-693782; BRL-MR-2004) Avail: CFSTI CSCL 6/16

If an aerosol is introduced between an observer and an object of interest, the apparent contrast between the target and background will decrease. The mechanism of contrast reduction depends on meteorological conditions, the testing geometry, and the way radiation interacts with the aerosol. Some previous approaches to the problem and their limitations are discussed. The mechanism of contrast reduction is described and related to relevant properties of aerosols. A specific design for a chamber to measure relevant aerosol properties is described. References to other work are included when alternative chamber design features are feasible. A Monte Carlo technique is described which can utilize measurements made in the chamber to obtain answers to tactical problems. Author (TAB)

N70-13473# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
BAROCLINIC INSTABILITY AND ATMOSPHERIC DEVELOPMENT
T. J. Simons Oct. 1969 66 p refs *Its* Atmospheric Sci. Paper No. 150
(Grant NSF GA-11637)
Avail: Issuing Activity

The baroclinic instability problem is formulated as an initial value problem in order to evaluate the effects of the initial configuration of the wave perturbation. The vertical shape of the initial perturbation is found to be as important as its wave length in determining the energy conversions during the early stages of its development. The general character of the solution of the initial value problem is compared with normal mode studies of baroclinic instability. It is concluded that the initial value formulation bridges the gap between normal mode solutions and non-linear studies. Author

N70-13482# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ON THE FEASIBILITY OF REMOTE ACOUSTIC SENSING OF LOW-LEVEL WINDS AND TEMPERATURES Final Report
H. L. Fox, R. Abilock, R. H. Lyon, and U. Ingard 20 Nov. 1968 79 p refs
(Contract PH-22-68-3)
(PB-185958; BBN-1735) Avail: CFSTI CSCL 04B

The following idea is explored: use sound to probe the atmosphere over a city in order to (1) obtain vertical profiles of winds and temperature valid for the city as a whole (horizontal averages), and (2) detect low-level temperature inversions. Nonuniform winds and temperatures cause sound rays to bend. In particular, rays tend to return to the ground during inversions. The considerable horizontal distance traveled by the rays also provides horizontal averaging. A basic system, comprising sound source, receiver arrays, and data processing equipment, would permit frequent soundings and interfere little with the city. Author (USGRDR)

N70-13488# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 214 14 Oct. 1969 p 6–15 refs (See N70-13484 03-13)
Avail: CFSTI

Abstracts of the following articles are presented: the distribution of the atmospheric transparency coefficient for total radiation flux over the USSR; random error estimation in the measurement of total ozone content with universal (M-83) and aircraft ozonometers; atmospheric ozone studies in the USSR during the IQSY period (1964-1965); accuracy in measuring the total ozone content in the zenith at USSR ozonometric stations; determination of the albedo of large sectors of the earth's surface from sky polarization measurements; laboratory and field test results for an automatic photometer (RDV-1) for measuring and registering atmospheric transparency; boundary layer parameter evaluations in planet atmospheres of the earth group; primitive and filtered equations in the hydrodynamics of meteorological fields; an approximate method for computing the polarization degree of outgoing radiation in the solar vertical; and the scattering and attenuation of radio emission in the centimeter range by hail. A method for measuring the charge and size of aerosol particles, and the establishment of an aerological station on the shores of the Bratsk reservoir are mentioned. M.H.E.

N70-13521# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology and Oceanography.
STUDIES IN THE DYNAMICAL PREDICTION AND INTERPRETATION OF WEATHER SYSTEMS Final Report, 1 Jan. 1967 – 30 Jun. 1968
Maurice B. Danard, T. N. Krishnamurti, and J. D. Mahlman Oct. 1968 13 p refs Sponsored by AFCRL
(AD-678081; NPS-51MZ8091A; AFCRL-68-0541) Avail: CFSTI CSCL 4/2

Four papers are summarized. The first describes a primitive equations model for use in the tropics. The second and third papers present a method for computing long-wave radiation from water vapor and investigate some consequences of radiation from cloud-top. The fourth paper describes numerical methods of computing 3-dimensional trajectories including diabatic effects. Author (TAB)

N70-13524# Sandia Corp., Albuquerque, N.Mex.
DATA FROM FALLING SPHERE EXPERIMENTS INCLUDING COMPARISON TESTS BETWEEN DIFFERENT SYSTEMS
Lawrence B. Smith 1969 20 p refs
(PB-185863; SC-DC-69-1997) Avail: CFSTI CSCL 04A

The comparison tests described in this paper have shown that the falling spheres technique provides atmospheric data in good agreement with other systems from 20 to about 70 km. The technique is also capable of altitudes much above 70 km although these tests indicate the errors in density so derived may be as great as 20 to 30 percent, significantly greater than the usual 5 to 10 percent error quoted. Author (USGRDR)

N70-13525# Stanford Research Inst., Menlo Park, Calif.
COMPARISONS OF MEASUREMENTS OF CLOUD MOTIONS Final Report
S. M. Serebreny, A. E. Brain, and R. G. Hadfield Aug. 1969 25 p
(Grant E-11-69-(N))
(PB-185872) Avail: CFSTI CSCL 04B

An optical apparatus was designed and constructed with which to study changes in cloud detail and to measure cloud displacement. With this apparatus four cloud photographs from ATS meteorological satellites can be projected individually, or simultaneously; time-lapse can be simulated. Cloud motion measurements previously obtained with a video console were compared with measurements obtained by the optical system. Author (USGRDR)

N70-13534# Weather Bureau, Silver Spring, Md. Space Operations Support Div.
PROBABILITY OF TROPICAL CYCLONE INDUCED WINDS AT NASA MANNED SPACECRAFT CENTER
Charles J. Neumann May 1969 51 p refs
(PB-185777; ESSA-TM-WBTM-SOS-4) Avail: CFSTI CSCL 04B

The study presents a statistical analysis of tropical cyclones as they affected the NASA Manned Spacecraft Center (located approximately midway between Houston and Galveston, Tex.) over the period of record from 1886 through 1967. The Poisson distribution is used to estimate the probability of the Center observing at least n occurrences of sustained 35-knot winds over k consecutive years ($n = 0.3$; $k = 1.20$). The bivariate normal distribution is used to estimate the probability of an existing tropical storm or hurricane producing sustained 35-knot winds at 24-hourly intervals and within 24-hourly intervals for prognostic periods of up to 4 or 5 days depending on the source region of the storm. Presented also are charts and figures depicting the general Gulf of Mexico tropical cyclone climatology. This study is modeled after a 1968 study which presented similar data for the Kennedy Space Center, Fla. Author (USGRDR)

N70-13562# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 212 16 Sep. 1969 p 7-8 refs (See N70-13560 03-13)
Avail: CFSTI

A brief discussion description is given of routine computerized processing of meteorological information. News articles are presented on the opening of the Belorussion Republic Hydrometeorological Center and on a new radiosonde for measuring atmospheric temperature. N.E.N.

N70-13579# Montana State Coll., Bozeman. Dept. of Earth Sciences.
ATMOSPHERIC WATER RESOURCES PROGRAM Final Report, 16 Nov. 1968 - 30 Jun. 1969
Arlin B. Super, Robert H. Yaw, and Angelito R. Sandoval 30 Jun. 1969 68 p refs
(Contract DI-14-06-D-6144)
(PB-186122) Avail: CFSTI CSCL 04B

During the winter of 1968-69 a randomized seeding program was conducted in the Bridger Mountains north of Bozeman, Montana. The intent of the program was to seed air moving over the orographic barrier of the Bridger Mountain Range and determine the effectiveness of the seeding in a target area downstream on the slopes of the Bangtail Mountains. Precipitation measurements were made with a network of 22 high resolution weighting gages. Temperature, moisture, winds, and ice nuclei were measured at the Bangtail Mountain Observatory in the target area. Precipitation data were analyzed by three methods: (1) a target-control method which involved the normalization of precipitation data prior to use; (2) factor analysis; and (3) eigenvector analysis. Author (USGRDR)

N70-13580# Stanford Research Inst., Menlo Park, Calif.
ANTARCTIC ATMOSPHERIC TRANSPORTS AND RELATED SATELLITE VIEWED CLOUD COVER, JANUARY 1967 Final Technical Report
Paul A. Davis and Eldon J. Wiegman Aug. 1969 68 p refs
(Grant NSF GA-4211)
(PB-186349) Avail: CFSTI CSCL 04B

The basic objective of this research was to examine the extent to which satellite-viewed summertime cloudiness around Antarctica relates to atmospheric transports of momentum, kinetic energy, and heat to and from the Antarctic. Corollary objectives included the extraction of useful quantitative summaries of satellite data from the Antarctic and the design of meaningful numerical procedures to describe the atmospheric transports on the basis of meteorological data collected in Antarctica. An ultimate objective is to provide a means for translating satellite data into pertinent input for models of the general circulation. Such models must be capable of maintaining a proper global energy balance. Author (USGRDR)

N70-13581# National Meteorological Center, Suitland, Md.
NORTHERN HEMISPHERE CLOUD COVER FOR SELECTED LATE FALL SEASONS USING TIROS NEPHANALYSES
Philip F. Clapp Dec. 1968 25 p refs
(PB-186392; ESSA-TM-WBTM-NMC-44) Avail: CFSTI CSCL 04B

Northern Hemisphere fields of mean cloudiness were constructed using TIROS nephanalyses for the late-fall seasons (Oct. to Dec.) of 3 years, 1962-64. These may be useful in studies of cloud climatology and year-to-year variations of the earth-atmosphere heat budget; and for designing and testing cloud-modeling procedures in numerical experiments. Shortcomings were revealed in the present subjective nephanalysis documentation which hopefully will soon be corrected by the promising work now going on in digitizing the video pictures. Author (USGRDR)

N70-13584# Sperry Rand Research Center, Sudbury, Mass.
CAPABILITIES OF MILLIMETER WAVE RADIOMETERS FOR REMOTELY MEASURING TEMPERATURE PROFILES PERTINENT TO AIR POLUTION Final Report, 6 Feb. 1967 - 5 Feb. 1968
W. D. Mount, A. C. Anway, C. V. Wick, and C. M. Maloy 5 Feb. 1968 62 p refs
(Contract PH-86-67-76)
(PB-186189; SRRC-CR-68-19) Avail: CFSTI CSCL 04B

Analytical and experimental results are presented for remotely measuring low-level air temperature profiles with a millimeter wave radiometer. Nearly a one-to-one correspondence exists between the radiometric and the radiosonde and/or tower data output for superadiabatic and other lapse temperature conditions. A measure of the height and magnitude of temperature inversions was also obtained remotely with the radiometric techniques. The radiometric magnitude of the inversion is consistently less than that measured directly and, as yet, no attempt has been made to correct for this bias. The feasibility has been established for measuring remotely the unstable, neutral, and stable meteorological conditions pertinent to air pollution problems. Author (USGRDR)

N70-13587# Weather Squadron (24th), Detachment 17, Williams AFB, Ariz.
TERMINAL FORECAST REFERENCE FILE, 1968 Final Report
Larry J. Kluth 1968 55 p refs Revised
(AD-678038) Avail: CFSTI CSCL 4/2

The reference file discusses factors affecting the weather at Williams AFB, Ariz. Included are location and topography, weather controls, climatic aids and local forecast studies. Author (USGRDR)

N70-13589# Weather Bureau, Honolulu, Hawaii.
VERIFICATION OF AN OBJECTIVE METHOD TO FORECAST FRONTAL PASSAGES IN THE HAWAIIAN ISLANDS
Edward M. Carlstead Sep. 1969 12 p refs
(PB-185776; ESSA-TM-WBTM-PR-6) Avail: CFSTI CSCL 04B

The University of Hawaii, under Techniques Developed Laboratory sponsorship, has developed an objective technique to forecast the probability of frontal passage within 24 hours at four Hawaiian stations. 1271 forecasts of frontal passage within 24 hours at these stations were made for a synoptic surface chart series independent of the basic series used to derive the objective forecast technique. Results are shown and discussed. Author (USGRDR)

N70-13590# Sandia Corp., Albuquerque, N.Mex.
CLIMATOLOGY OF TONOPAH TEST RANGE, 1968
J. R. Schaeffer Aug. 1969 81 p Sponsored by AEC
(PB-185853; SC-M-69-488) Avail: CFSTI CSCL 04B

Contents: Tables and graphs of temperature, relative humidity, station pressure, precipitation, and surface wind, 1968; Tables and graphs based on 8-year averages of meteorological elements at Tonopah test range, 1961-1968; Summaries of upper winds, 1961-1968. USGRDR

N70-13591# Weather Bureau, Salt Lake City, Utah.
HIGH RESOLUTION RADIOSONDE OBSERVATIONS
W. S. Johnson Aug. 1969 21 p refs
(PB-185673; ESSA-TM-WBTM-WR-41) Avail: CFSTI CSCL 04B

A method to obtain high resolution in the temperature and humidity profiles, particularly in the first 2000 feet above surface, by the radiosonde is described. The modifications to equipment use standard available items. The modifications provide a dual channel GMD telemetry system that gives nearly continuous recorder traces of both temperature and humidity interrupted only for the high and low references. The flight train consists of one 300-gram balloon, two standard parachutes and two standard 1680 MHz radiosondes strapped or tied together. Author (USGRDR)

N70-13592# Weather Bureau, Salt Lake City, Utah.
ANALYSIS OF THE SOUTHERN CALIFORNIA SANTA ANA OF JANUARY 15-17, 1966
Barry B. Aronovitch Aug. 1969 43 p refs
(PB-185670; ESSA-TM-WBTM-WR-42) Avail: CFSTI CSCL 04B

A meteorological analysis of conditions during the severe Santa Ana of January 15-17, 1966 is given, with emphasis on the 500-mb flow. The gradient-wind equation defines the maximum contour curvature which a parcel of air can follow dynamically for a given wind speed. If this maximum is exceeded, the parcel trajectory may become anticyclonic. This condition is related to the so-called 'wet' Santa Ana. Author (USGRDR)

N70-13654# Weather Bureau, Kansas City, Mo.
SEASONAL ASPECTS OF PROBABILITY FORECASTS. PART 4: SPRING
Lawrence A. Hughes Feb. 1969 23 p refs
(PB-185736; ESSA-TM-WBTM-CR-27) Avail: CFSTI CSCL 04B

Probability forecasts of measurable precipitation in 12 and 6 hour periods have been made by stations in the Central Region from September 1965 to date. The sample herein is for 24 months from April 1966 through March 1968. The year was divided into four meteorological seasons of three months each as follows: summer – June, July, August; winter – December, January, February; the fall and spring months were appropriately between these seasons. Author (USGRDR)

N70-13684# Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
ECOLOGICAL EFFECTS OF WEATHER MODIFICATION A PROBLEM ANALYSIS
Charles F. Cooper and William C. Jolly May 1969 165 p refs
(Contract DI-14-06-D-6576)
(PB-185767) Avail: CFSTI CSCL 04B

If deliberate modification of weather can be achieved, the structure of plant and animal communities will be altered through shifts in rates of reproduction, growth, and mortality of weather sensitive species. Ecological changes will generally require several years to become fully evident. Weather modification may interact with other ecological stresses such as air pollution and pesticide application to produce changes greater than the sum of the individual effects. The report includes sections on anticipated kinds of weather modification. Author (USGRDR)

N70-13698# McGill Univ., Montreal (Quebec). Stormy Weather Group.
VARIATIONS WITH HEIGHT AND INTENSITY OF SHOWER ECHO MOTION Progress Report
R. W. Shaw 12 Aug. 1969 3 p refs
(Contract ESSA E22-14-69(N))
(PB-186391) Avail: CFSTI CSCL 04B

Trajectories and hodograms for one storm are given without analysis. It is suggested that analysis will indicate the origin and circulation of air in a convective storm. The distribution of precipitation with intensity, height, and time is given for the storm studied. The same period of time has also been covered with measurements of horizontal motion at heights from 1.5 to 12.1 km for six values of target intensity. The report is limited to the motions of the centroid of the contour of lowest detectable intensity and to motions of the maximum-intensity cores. USGRDR

N70-13725# Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
CHEMICAL TEMPERATURE INTEGRATION Final Report
Richard Lee 25 Feb. 1969 8 p refs Revised
(Grant ESSA E210-67(G))
(PB-186401) Avail: CFSTI CSCL 04B

The sugar-inversion method (Pallmann method) of deriving mean temperatures related the reaction velocity of sucrose hydrolysis to temperature by means of an Arrhenius-type equation. The method was tested for precision, accuracy and adaptability to climatological networks. Author (USGRDR)

N70-13799# Weather Bureau, Kansas City, Mo.
SEASONAL ASPECTS OF PROBABILITY FORECASTS. PART 3: WINTER
Lawrence A. Hughes Dec. 1968 28 p refs
(PB-185735; ESSA-TM-WBTM-CR-26) Avail: CFSTI CSCL 04B

Probability forecasts of measurable precipitation in 12 and 6 hour periods have been made by stations in the Central Region from September 1965 to date. The sample herein is for 24 months from April 1966 through March 1968. Author (USGRDR)

N70-13973# RAND Corp., Santa Monica, Calif.
THE INFLUENCE OF VARIABLE SEA ICE ON THERMAL FORCING OF GLOBAL ATMOSPHERIC CIRCULATION
J. O. Fletcher Aug. 1969 22 p refs Presented at Conf. on the Global Circulation of the Atmosphere, London, 25 - 29 Aug. 1969 Sponsored in part by NSF
(PB-185819; P-4175) Avail: CFSTI CSCL 04A

Ice extent on the sea is one of the important variable features of the global system. It influences the global system by regulating heat exchange between ocean and atmosphere, and thus influencing the intensity of the polar heat sinks. In the northern eemisphere secular sea ice variations tend to counter observed trends of global circulation intensity, so they are a consequence but not a contributing cause of global variations. In the southern hemisphere variable ice extent is much more important and both annual and longer term variations reinforce observed trends of global circulation intensity. The report gives examples of how ice cover reduces heat exchange between the atmosphere and the ocean, both during winter and summer. Author (USGRDR)

N70-14006# Institut Royal Météorologique de Belgique, Brussels.
THE WEATHER DURING 1968 [LE TEMPS EN 1968]
R. Sneyers 1969 51 p In FRENCH *Its* Publ. Ser. B, No. 55 Avail: CFSTI

A survey is presented of climatic conditions during 1968 over Belgium. Annual mean values are compared with mean values computed over a large period and monthly reports are included. ESRO

N70-14028# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 216 14 Nov. 1969 p 4–53 refs (See N70-14026 03-13)
Avail: CFSTI

News releases and abstracts of scientific articles are presented. The topics covered include the following: rocket sounding; airborne equipment; atmospheric circulation and turbulence; wind profiles and air current structure; atmospheric temperature and pressure; cloud physics; aerosol sources and concentration; storm duration and fog and hail formation; radar and infrared attenuation in the atmosphere; long range, short range, numerical, and statistical weather forecasting; and ground water and geopotential determinations. N.E.N.

N70-14035# Consiglio Nazionelle Delle Richerche, (Italy). Inst. di Fisica dell'Atmosfera.
THUNDERSTORM STUDIES AT VERONA, ITALY
Griffith M. Morgan, Jr. Mar. 1969 19 p Presented at the Conf. on Severe Local Storms, Chicago, 8–10 Apr. 1968
(IFA-TR-27) Avail: CFSTI

The Verona Hailstorm Observatory is described, together with a brief discussion of the hail problem in the Po Valley. A fairly typical example of a hail situation is shown to illustrate the complexities introduced by the terrain. Some problems facing the Italian hail program, and its general aims are discussed. Author (ESRO)

N70-14059# Library of Congress, Washington, D.C. Aerospace Technology Div.
COMMUNIST-BLOC METEOROLOGICAL SYSTEMS AND SENSORS Surveys of Foreign Scientific and Technical Literature
Lee Boylan 5 Aug. 1969 77 p refs *Its* Work Assignment No. N-69-4
(AD-694436; ATD-69-118) Avail: CFSTI CSCL 4/2

Contents: Soviet hydrometeorological service and systems development; Radar meteorology; Meteorological data processing; Instruments and components; (Wind, precipitation, temperature, humidity, visibility, radiation, and support components.) TAB

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-13269# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A CONCEPT FOR AIR TRAFFIC CONTROL
Herbert G. Weiss 17 Oct. 1968 31 p refs
(Contract AF 19(628)-5167)
(AD-678060; TN-1968-29-Rev; ESD-TR-68-264) Avail: CFSTI CSCL 17/7

To increase the number of aircraft which can operate safely in high traffic areas and to expedite traffic at busy airports, it is proposed that each commercial flight travel along a flight tube reserved for its exclusive use. An instrumentation system is described which would continuously provide an aircraft with accurate position information and instructions for progressing along any selected flight tube. Every few seconds each aircraft would report its identity, position, and altitude via a digital air-to-ground data link to the Air Traffic Control centers. This information will enable the centers to monitor all aircraft movements, and deviation. Author (TAB)

N70-13279# Sandia Corp., Aubuquerque, N.Mex.
APPLICATION OF FLUIDICS TO ATTITUDE AND GUIDANCE CONTROL OF SATELLITES AND ROCKETS [APPLICATION DE LA FLUIDIQUE AU CONTROLE D'ATTITUDE ET AU PILOTAGE DES SATELLITES ET DES FUSEES]
J. P. Pujes Sep. 1969 16 p refs Transl. into ENGLISH from L'Aeron. et L'Astron., (France), v. F, 1968 p 43–49
(PB-186103T; SC-T-69-1044) Avail: CFSTI CSCL 17G

The first part of this document is devoted to a general survey of fluidics and its applications. It includes a brief description of the principal fluidic devices. The second part deals with attitude control and guidance of satellites, space probes and rockets. Work already done is mentioned. The purely spatial applications of fluidics are essentially limited to the attitude control and to the guidance of satellites, as well as to space probes and rockets. Author (USGRDR)

N70-13800# European Space Operations Center, Darmstadt (West Germany).
ATTITUDE DETERMINATION FOR THE SATELLITE ESRO 2. PART 1: PRINCIPLES
R. E. Münch Dec. 1968 38 p refs
(ESRO-SR-10-ESOC) Avail: CFSTI

The mathematical and technical principles for the evaluation of the spin axis attitude of the satellite ESRO 2 (IRIS) are presented. A direct method based on measurements, as well as a refined method utilizing a dynamical model for the spin axis motion, are developed. The procedures for realizing these methods and various results will be set out in Part 2 of this report. Author (ESRO)

N70-13829# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
COMPLEMENT ON THE SIX-IMPULSE, OPTIMAL RENDEZVOUS OF MEDIUM DURATION, BETWEEN NEAR-CIRCULAR, NON COPLANAR, CLOSE ORBITS [COMPLEMENT SUR LES RENDEZVOUS HEXA-IMPULSIONNELS, OPTIMAUX, DE DUREE MOYENNE ENTRE ORBITES QUASI-CIRCULAIRES PROCHES, NON COPLANAIRES]
Jean-Pierre Marec 1969
19 p refs In FRENCH; ENGLISH summary Presented at the 20th Intern. Astronautics Congr., Mar del Plata, Arg., 6–10 Oct. 1969 Submitted for publication
(ONERA-TP-783) Avail: CFSTI

In a previous analytical study on multi-impulse, optimal rendez-vous of medium duration, between near circular, non coplanar, close orbits, a first family of six-impulse solutions was deduced. A second family of six-impulse solutions, studied here, appears when the orbital planes are very close, a case which was omitted from the previous study because it required special treatment. The resolution of the problem is based on the study of the evolution, as a function of time, of the length of the primer vector. For a well defined rendez-vous of the second family, the impulses are nearly tangential and are applied in the first and the last revolution. The six-impulse (2nd family) portion of the domain, in the space of the variations of the orbital elements, is studied for an iso-energetic rendez-vous in which the line of nodes is perpendicular to the axis of symmetry of the transfer arc and takes place in an integral number of revolutions. Author (ESRO)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-12722# Japan Atomic Energy Research Inst., Tokyo. Office of Power Reactor Projects

RESEARCH AND DEVELOPMENT OF THE FUEL ASSEMBLY FOR JAPAN EXPERIMENTAL FAST REACTOR (FOX PROGRAM)

Apr. 1969 78 p refs In JAPANESE; ENGLISH summary
(JAERI-1182) Avail: CFSTI

Experiences of fabrication and characteristic tests of fuel assemblies designed for Japan Experimental Fast Reactor (JFER) are described. After completion of the preliminary design of JFER in 1964, trial fabrications of its fast oxide fuel assemblies were started. According to the design evolution of JFER, these fabrications followed each design. Characteristic tests of fuel assembly, such as hydraulic flow test, material strength test, sodium soaking test, and mechanical characteristic measurement were performed for each fuel assembly. Fabrications were performed in ex-AFC (present PNC) and JAERI. Design and various tests of the fuel assembly were carried out in JAERI. Results of these R & D are reflected in designing the fuel assemblies of next stage of design evolution of JFER. Author

N70-12729# Japan Atomic Energy Research Inst., Tokyo. Nuclear Data Committee.

PRODUCTION OF GROUP CONSTANT FOR REACTOR ANALYSIS

Dec. 1968 192 p refs
(JAERI-1176) Avail: CFSTI

Descriptions are presented of the functions and characteristic features of the processing programs for converting nuclear data into group constants, analyzing resonance cross sections, evaluating angular distributions, and producing parameters of thermal cross sections. Comparisons are made of various nuclear data, such as those on thermal cross section, epithermal and fast cross sections, inelastic scattering, and the quantities related to fission neutrons. Many discrepancies and inconsistencies were found. The group constants are also compared with those obtained previously. Author

N70-12747# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

SNAP 23A, PHASE 1 Quarterly Progress Report, 1 Mar.–31 May 1969

W. S. Wilgus Jun. 1969 94 p refs
(Contract AT(30-1)-3800)
(WANL-3800-33; WANL-PR-SS-28) Avail: CFSTI

Testing of the experimental mockup system continued during the period. A safety analysis was completed for use with the application for the heat source shipping license. Stress analysis of the fuel capsule was completed. Life testing of thermal insulation Min-K 2000 and Min-K 2002 continued during the period. Other activities are also reported on program management and liaison engineering. NSA

N70-12795# General Electric Co., Sunnyvale, Calif.

SODIUM COMPONENTS DEVELOPMENT PROGRAM. MASS TRANSFER INVESTIGATIONS IN LIQUID METAL SYSTEMS Quarterly Progress Report, Mar.–May 1969

Jun. 1969 35 p refs
(Contract AT(04-3)-189)
(GEAP-10036; QPR-9) Avail: CFSTI

Activities in a program to determine corrosion rates in candidate reactor structural materials, the effects of corrosion on mechanical properties, and the effects of corrosion on Na impurities are reported. The studies are being conducted using test loops at 1300 F. Materials being studied include Types 304, 316, and 347 stainless steels and Incaloy 800. Efforts during the report period were devoted to corrosion studies on Type 316 stainless steel in sodium loop run 8–4 at 1300 F and to sodium–impurities interactions. Work is also reported on efforts to determine the mechanical properties limits for cladding materials and localized attack parameters. NSA

N70-12804# Oak Ridge National Lab., Tenn.

NEUTRONIC BEHAVIOR OF TWO FUSION REACTOR BLANKET DESIGNS

Don Steiner Jul. 1969 17 p refs Presented at Intern. Conf. on Nucl. Fusion Reactors, Culham, Engl. 17-19 Sep. 1969 Submitted for publication Sponsored by AEC
(Contract W-7405-eng-26)
(ORNL-TM-2648; CONF-690901-1) Avail: CFSTI

Two fusion reactor blanket designs have been compared on the basis of their neutronic behavior. The comparison included the areas of (1) tritium breeding, (2) nuclear heating, and (3) neutron irradiation effects within the vacuum wall, i.e., neutron-induced atom displacements and helium and hydrogen production. The two designs investigated differed only in their assumed vacuum wall coolants; design 1 employs lithium as the vacuum wall coolant, design 2 employs lithium-beryllium fluoride (flibe) as the vacuum wall coolant. It is concluded that the neutronic behavior of a fusion reactor blanket employing lithium as the vacuum wall coolant is superior to that of one employing flibe. Author (NSA)

N70-12809# Tube Investments Ltd., Walsall (England). Steel Tube Div.

TUBES FOR NUCLEAR PLANTS

R. Wright 1968 21 p Presented at the British Nucl. Forum and Deutsches Atomforum Meeting, Frankfurt am Main, Germany
(CONF-681064-8) Avail: CFSTI

The wide range of materials, fabrication processes, sizes, and special types of tubes produced by British tube manufacturers is summarized. Experience in the production and quality control of tubes with integral and with welded-on fins is discussed. NSA

N70-12830# Oak Ridge National Lab., Tenn. Reactor Div.

REFERENCE STATE-OF-THE-ART DESIGN AND TECHNOLOGICAL ASSESSMENT OF A 1500-KW(E) PRESSURIZED-WATER REACTOR

G. Samuels and M. E. Lackey, ed. Aug. 1969 418 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2604) Avail: CFSTI

A pressurized-water plant for producing 1500 kW of electricity and 2500 kW of export heat is described. This conceptual design is based on the current state of the art. The plant has a thermal output of 11,750 kW and is assumed to be the prime source of power for a remote land-based installation. It rejects waste heat to the atmosphere from air-cooled condensers. The reactor core consists of a single assembly containing 1702 Zircaloy-clad UO2 fuel elements, 102 Zircaloy-clad B4C–Zircaloy poison elements, and 120 stainless, steel-clad Ag–In–Cd control rods. The control rods are grouped into six assemblies composed of 20 absorber rods each. The core is designed for a minimum life of 50 MWyr. Author (NSA)

N70-12854*# National Aeronautics and Space Administration. Plum Brook Reactor Facility, Sandusky, Ohio.

LOSS OF FORCED COOLING FLOW IN THE PLUM BROOK REACTOR

H. B. Barkley, Jr. Washington Dec. 1969 11 p Presented at ANS Topical Meeting on Reactor Operating Experience, San Juan, Puerto Rico, 1-3 Oct. 1969
(NASA-TM-X-1931; E-5313) Avail: CFSTI CSCL 18K

The Plum Brook Reactor (PBR) experienced a temporary loss of forced-cooling flow in November, 1966. To provide a framework for understanding the occurrence, a brief description is given of the PBR, its electrical distribution system, and methods for maintaining flow. Then the occurrence is treated in three parts: causes; inspections and analyses conducted to evaluate the situation; and corrective action taken to avoid a recurrence. It is concluded in this case that an undesired rather than an unsafe condition existed. Author

N70-12869# Oak Ridge National Lab., Tenn.
AN EVALUATION OF STEAM COOLED FAST BREEDER REACTORS
Apr. 1969 360 p refs
(WASH-1088) Avail: CFSTI

The technical status and economic potential of three steam-cooled fast breeder reactor concepts that have inlet steam pressures of 1250, 2680, and 3700 psi are evaluated. The evaluation follows a set of specified ground rules, and all concepts are reviewed and analyzed on the basis of data on physics, thermal–hydraulic analysis, fabrication and engineering practices, and cost data. Attempts were made to incorporate equivalent engineered safeguards in all three concepts. It is concluded that no major technological breakthroughs would be required to solve the problems of constructing a successful and economic steam-cooled fast reactor. Breeding ratios of from 1.0 to 1.4 can be attained. NSA

N70-12906# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plant Div.
FINE STRUCTURE OF NEUTRON FLUX IN MODERATOR IN ENERGY RESONANCE REGION
S. Stech Feb. 1969 12 p refs
(ZJE-47) Avail: AEC Depository Libraries

The fine structure of the neutron flux in moderator is the consequence of a strong absorption in the low lying resonances (e.g. U 238). This fine structure in the layers of moderator near the fuel has the influence on a resonance absorption – the resonance integral. The contribution to the resonance integral is analyzed. The space dependent shape of the flux near a resonance energy is described. The numerical results are related to HWGCR cluster lattice cell. Author (NSA)

N70-12923*# Silverstein (Calvin C.), Baltimore, Md.
A STUDY OF HEAT PIPE APPLICATIONS IN NUCLEAR AIRCRAFT PROPULSION SYSTEMS Final Report
Calvin C. Silverstein 1 Dec. 1969 110 p refs
(Contract NAS3-11841)
(NASA-CR-72810; SIL-104) Avail: CFSTI CSCL 21F

Preliminary studies of heat pipe systems for reactor-to-jet engine heat transport and for emergency distribution of reactor afterheat over the surface of the reactor containment vessel are described. The reactor-to-jet engine heat transport system includes 5480 small-diameter reactor heat pipes, four large-diameter adiabatic heat transport pipes, and 8300 small-diameter heat pipes in each of the four engine heat exchangers. The total system weight is about 47,000 lb. The emergency afterheat distribution system includes 4280 heat pipes 1 in. in diameter and 11.7 in. long, whose total weight is 3400 lb. Author

N70-12936# Atomics International, Canoga Park, Calif.
INTERIM DESCRIPTION OF A COMPUTER PROGRAM (STP-1) FOR ESTIMATING THE DISTRIBUTION OF FISSION AND CORROSION PRODUCT RADIOACTIVITY IN A LIQUID METAL-COOLED FAST BREEDER REACTOR
G. B. Zwetzig and P. F. Rose 29 Jun. 1969 41 p
(Contract AT(04-3)-701) Avail: CFSTI
(AI-AEC-12847) Avail: CFSTI

The theory and interim status of the Source Term Computer Program (STP-1, Version 2) are described. This program is designed to compute the distribution in a liquid metal cooled fast breeder reactor of radioactivity both from fission product leakage from the fuel and from activation and corrosion of primary loop structural materials. The program accounts for this distribution between the fuel, cladding gas space, coolant, primary loop surfaces, cold traps, and cover gas. The program is now operational for a range of input parameters, though the integration scheme is not yet sufficiently stable to follow severe transients or to follow very short-lived fission product behavior. Author (NSA)

N70-12968# Gulf General Atomic, San Diego, Calif.
REACTOR ARRANGEMENT STUDIES FOR A LARGE HTGR PLANT
D. C. Morse and H. K. Wiard 31 Jul. 1969 44 p refs
(Contract AT(04-3)-167)
(GA-8439) Avail: CFSTI

A study is presented of possible arrangements of the reactor core and primary coolant system components within a single prestressed concrete reactor vessel for a 1000-MW(e) high-temperature gas-cooled reactor (HTGR) plant. Although the study deals primarily with the configuration of the prestressed concrete reactor vessel (PCRV) that houses the reactor and the primary coolant system, related questions concerning the number and size of primary system components are also considered. An arrangement based on the multicavity type of PCRV is recommended as the single vessel, integral-containment arrangement to be used in further work on the 1000-MW(e) plant. In this arrangement, the primary coolant system is composed of six parallel loops, each loop containing one steam generator and one He circulator. The reactor core is contained in a central cavity of the PCRV, while the steam generators and circulators are located in six smaller cavities in the side wall of the PCRV. Author (NSA)

N70-12970# Gulf General Atomic, San Diego, Calif.
DEVELOPMENT OF THE FLOW ANALYSIS CODE FLAC
G. J. Malek Jun. 1969 38 p
(Contract AT(04-3)-167)
(GA-9482) Avail: CFSTI

A flow analysis code, FLAC, was developed to perform flow distribution and thermal performance analyses on advanced HTGR reactors. The computer program is capable of analyzing flow distributions in arbitrary flow networks with heat addition. The program is written in FORTRAN S for the Univac 1108 computer. Author (NSA)

N70-12973# Bettis Atomic Power Lab., Pittsburgh, Pa.
THE HOT-PRESSING BEHAVIOR OF SINTERED LOW-DENSITY PELLETS OF URANIUM DIOXIDE, ZIRCONIUM DIOXIDE-URANIUM DIOXIDE, THORIUM DIOXIDE, AND THORIUM DIOXIDE-URANIUM DIOXIDE. LWBR DEVELOPMENT PROGRAM
S. F. Kaufman May 1969 54 p
(Contract AT-11-1-GEN-14)
(WAPD-TM-751) Avail: CFSTI

The out of pile hot-pressing behavior of sintered low density oxide fuel pellets of UO_2, ZrO_2-UO_2, ThO_2, and ThO_2-UO_2 was investigaged over a temperature range of 1600 to 2150 C to obtain supplemental creep data for use in predicting the pore closure rates during irradiation. The results obtained correlated well with results of out of pile compression creep tests performed on dense pellets. For the UO_2-ZrO_2 strain rates computed from porosity changes varied linearly with the applied stress and agreed with compression creep data within a UO_2-ZrO_2 of three. Test results on UO_2 were limited, but more extensive results on ThO_2 and ThO_2-UO_2 compositions showed a transitional, stress dependent behavior in agreement with compression creep data. Quantitatively, the hot pressing data for ThO_2-UO_2 compositions did not agree with compression creep data as well as the hot pressing data for the UO_2-ZrO_2 compositions and were generally much lower at higher temperatures. Changes in stoichiometry to a hypostoichiometric state resulting from use of the carbonaceous atmosphere are believed to be responsible for the lower observed creep rates. Author (NSA)

N70-12975# Oak Ridge National Lab., Tenn.
FABRICATION OF SOL-GEL-DERIVED THORIA-URANIA BY COLD PRESSING AND SINTERING
J. M. Robbins and J. G. Stradley Jul. 1969 23 p Presented at 69th Ann. Meeting, The Am. Ceramic Soc, New York, 2 May 1967

(Contract W-7405-eng-26)
(ORNL-4426; CONF-670557-1) Avail: CFSTI

The use of the cold press and sinter technique for producing sol-gel thoria-urania fuel pellets was investigated. Sol-gel powder calcination temperature, moisture content, uniaxial and isostatic forming pressures, and sintering atmospheres were studied. The sol-gel powder was characterized by DTA, TGA, and BET surface area techniques. The sintered fuel pellets were evaluated in terms of shrinkage, density, and oxygen-to-uranium ratio. Shrinkages ranged from 16 to 20%, bulk densities ranged from 78 to 95% of theoretical, and the oxygen-to-uranium ratio was changed from 2.67 to 2.00 by hydrogen reduction. Author (NSA)

N70-12995# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
THEORY FOR SOURCE JERK EXPERIMENTS WITH AN EXTERNAL SOURCE
M. J. Bridge Jul. 1969 30 p refs
(RD/B/N-1191) Avail: AEC Depository Libraries

The theory of the source jerk method was studied for some experiments in which the source was a neutron generating tube outside the reactor. The spatial dependence of the experiment was investigated using the CRAM program to predict initial and time-integrated fluxes in the reactor. A brief review of previous theoretical work on the source jerk experiment is given, and the development of the two-group theory as used in the present calculations is explained. The theoretical results, although not directly applicable to the particular experiments performed, are compared with some experimental results to confirm the general trend of the calculations. The calculations are used to indicate the measuring position for which zero spatial corrections apply. A calculation for a central source is compared with the cases of external source. Author (NSA)

N70-12996# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
SOURCE JERK EXPERIMENTS USING AN EXTERNAL SOURCE
W. Mountain and R. H. Waterson Jul. 1969 20 p refs
(RD/B/N-1188) Avail: AEC Depository Libraries

The extension of the source jerk technique to use on a reactor with an external neutron generator is described. The problems arising from the large spatial effects encountered are discussed, and the method of analysis employed is described. It is concluded that the technique as used gives an uncertainty of < + or − 5% on reactivity in the range from critical k sub eff = 0.98. Author (NSA)

N70-13007# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems Div.
POST-IRRADIATION EXAMINATION OF CVTR FUEL ASSEMBLIES Final Report
M. G. Balfour and J. F. Mellor Aug. 1969 208 p refs
(Contract AT(30-1)-3850)
(WCAP-3850-4) Avail: CFSTI

A program of post-irradiation examinations was conducted upon failed CVTR standard core and experimental fuel rods to determine the nature and the causes of the defects. The examinations showed a single rod failure in each of two standard assemblies and in three of four special high power test assemblies. The failures generally are characterized by multiple clad defects, with localized internal hydriding, but no correlation was found in terms of design or irradiation performance to account for them. The evidence suggests that the failures were caused by local hydriding and consequent embrittlement of the Zircaloy clad combined with clad stresses. The source of internal hydriding is related to the fabrication history peculiar to each rod. Author (NSA)

N70-13011# Gulf General Atomic, San Diego, Calif.
SMALL-SCALE TENDON FRICTION TESTS
G. S. Chow and J. F. Hildebrand 5 Jun. 1969 32 p ref
(Contract AT(04-3)-633)
(GAMD-9379) Avail: CFSTI

Small-scale tendon friction tests for a prestressed concrete reactor vessel (PCRV) are described. The tests were conducted to evaluate the relative lubricity of the proposed lubricants by stressing a seven-wire (1/4-in.-diameter) tendon through a 1-5/16-in.-diameter tube. The results of this series of tests in conjunction with the results of radiolysis tests on the same lubricants will be used in selecting the most suitable coating material for the R & D Friction Test Program using full-size (168-wire) tendons and simulating the Prestressing System for the PCRV of the Fort St. Vrain Power Reactor. A summary of the friction test results is tabulated and evaluation of the test results is discussed. Author (NSA)

N70-13029# Sandia Corp., Albuquerque, N.Mex.
HECON COMPUTATIONS FOR THE DIFFUSION OF HELIUM IN ALPHA-EMITTING ISOTOPES
C. J. M. Northrup, Jr. and D. E. Amos May 1969 42 p refs
(SC-RR-69-103) Avail: CFSTI

Alpha-emitting isotopic compounds are being used as heat sources for electrical generators. Because these compounds continuously produce helium, the behavior of the gas in each of the compounds is of great interest to engineers that are designing such systems. It has been demonstrated experimentally that some of the isotopic fuels will retain helium at lower temperatures. These fuels may rapidly release the stored gas if they are taken to high temperatures. Thus, there is considerable interest in the safety aspects of thermally cycling alpha-emitting compounds, since high pressures may be created in minutes. Two programs were obtained for diffusion in alpha-emitting compounds. An analytic solution is programmed as HECON1, and the program for the numerical solution is called HECON2. In general, HECON1 is limited to ideal laboratory conditions, but HECON2 can follow transients and complicated histories, such as might be seen by actual fuels. A Fortran computer program for the CDC-3600/6600 computers is included for the HECON2 solution. Author (NSA)

N70-13037# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MULTIDECADE NUCLEAR REACTOR SIMULATION USING HYBRID COMPUTER AUTOMATIC RESCALING TECHNIQUES
J. R. Patterson Aug. 1969 38 p refs
(Contract AT(45-1)-1830)
(BNWL-1099) Avail: CFSTI

A method of applying floating point techniques to an analog problem was used to simulate a nuclear reactor from startup level to full power. A hybrid computer was used to execute the problem, the digital computer being used to store and operate on the exponents of the variables, while the analog was used to operate on the mantissas. The method is an extension of the point storage (or analog memory) rescaling technique, and is applicable to a wide-range of miltidecade problems. Author (NSA)

N70-13043# Battelle-Northwest, Richland, Wash.
FFTF REACTOR VESSEL CONCEPT EVALUATION SUMMARY
D. J. Oakley, comp. Jul. 1969 128 p refs Supercedes BNWL-1001; <N69-38496<
(Contract AT(45-1)-1830)
(BNWL-1011; BNWL-1001) Avail: CFSTI

Two proposed design concepts of the FFTF reactor pressure vessel were comparatively evaluated for the purpose of selecting the configuration demonstrating the greater overall advantage. The two concepts, the annular inlet and piped bottom inlet, differ primarily in location of inlet nozzles, method of vessel wall cooling, and containment of system inlet pressure. Principal areas of the study involved methods of fabrication, ease of inspection, thermal

balance, individual design features, accident containment capabilities, shock and vibration responses, heat transport and emergency cooling factors, and cost. Results of the detailed evaluations were concluded, from the standpoint of overall advantages, to favor the piped bottom inlet concept. Author (NSA)

N70-13048# Oak Ridge Operations Office, Tenn. Research Labs.
MINIMUM SAFETY REQUIREMENTS, 1968
1968 101 p
(PB-186222) Avail: CFSTI CSCL 18M

It is the intent of these safety requirements that a level of performance on safety, fire protection, and health shall be maintained consistent with nationally recognized standards, but that they shall not unnecessarily restrict the use of equipment, procedures, operations, or methods. No attempt has been made to cover all the health, safety, and fire prevention regulations and requirements of the Commission, nor to cover all the phases of safety. Only the more common safety practices having general application to operating and construction work have been included. These are minimum safety requirements designed for and shall apply to all types of contractor operations under the jurisdiction and supervision of the Oak Ridge Operations Office, Atomic Energy Commission. Author (USGRDR)

N70-13068# Oak Ridge National Lab., Tenn.
PROFIL: A ONE-DIMENSIONAL FORTRAN 4 PROGRAM FOR COMPUTING STEADY-STATE TEMPERATURE DISTRIBUTIONS IN CYLINDRICAL CERAMIC FUELS
C. M. Cox and F. J. Homan Aug. 1969 53 p
(Contract W-7405-eng-26)
(ORNL-TM-2443) Avail: CFSTI

Four changes have been made in the PROFIL code. A thermal conductivity function employing a polynomial curvefit of literature data has been added, primarily for carbide and nitride fuels. Alterations have been made in the flow diagram to simplify use of the code. A variable beta factor has been added, which is porosity dependent; and the convergence criteria for calculating the temperature at the inside incremental boundary have been modified to increase flexibility. Author (NSA)

N70-13069# Los Alamos Scientific Lab., N.Mex.
ULTRA HIGH TEMPERATURE REACTOR EXPERIMENT (UHTREX) Quarterly Status Report
10 Jul. 1969 14 p refs
(Contract W-7405-eng-36)
(LA-4207-MS) Avail: CFSTI

Operations during February to April 1969 are described. Core loading and fuel worth measurements are presented. Test programs and maintenance requirements are reviewed. Fuel element fabrication and corrosion observations are described. Author (NSA)

N70-13072# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.
ALUMINA FORMATION ON THE DIDO-PLUTO CLASS OF REACTORS
E. T. Smith, G. F. Aitchison, and J. Monohan May 1969 52 p refs
(AERE-R-6105) Avail: CFSTI: HMSO 5s, 6d

There is ample evidence to show that control of the pH (or pD) value at an optimum value appears to be one method of preventing Al2O3 formation, as has been demonstrated on the DIDO, PLUTO, DMTR and DR3 reactors. The HIFAR reactor has remained free from Al2O3 formation, and this has been attributed to the maintaining of high standards of purity both in the reactor He blanket and in the D2O circuit; the purity of the latter has been achieved by continuous ion-exchange purification using a mixed-bed column which has resulted in a higher pD value. Several techniques have been successfully used for the removal of suspended Al2O3, the only problem is the selection of the best method for the reactor system being assessed. A survey of the various experiences on several reactors is given which may be of use to future workers in this field. Author (NSA)

N70-13078# India. Dept. of Atomic Energy, Bombay.
ATOMIC ENERGY DEPARTMENT OF BOMBAY, INDIA Annual Report, 1968–1969
1969 87 p
(ND-17988) Avail: CFSTI

The annual report includes brief discussions on the Bhabha Atomic Research Center, Tata Institute of Fundamental Research, Physical Research Laboratory, Saha Institute of Nuclear Physics, Tata Memorial Center, space research, Atomic Minerals Division, industrial operations, atomic power, and international relations. NSA

N70-13087*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATIONS OF SNAP-8 SHUTDOWN CHARACTERISTICS
Thomas P. Hecker Nov. 1969 73 p refs
(NASA-TM-X-52730) Avail: CFSTI CSCL 18I

An experimental study of the shutdown of a SNAP-8 power conversion system was conducted to determine the transient response of the system to two shutdown modes, viz., a normal shutdown and an emergency shutdown. For the emergency shutdown, a failure of the condenser-coolant pump was simulated. Neither mode of shutdown resulted in parametric excursions beyond the limit considered safe for the components. Transient data for three normal shutdown tests and three emergency shutdown tests are presented. Author

N70-13088*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF PUMP TRANSFER FREQUENCIES FROM AUXILIARY POWER TO ALTERNATOR POWER DURING STARTUP OF THE SNAP-8 SYSTEM
Ronald H. Soeder and Roy A. Lottig 13 Nov. 1969 57 p refs
(NASA-TM-X-53712) Avail: CFSTI CSCL 18I

A critical parameter in the startup of the SNAP-8 system is the frequency of the battery-inverter unit that powers the four pumps prior to transfer to the power output of the accelerating turbine-alternator. This frequency should be as low as possible in order to reduce inverter power and, hence, battery weight. Pumping requirements during startup, however, dictate a minimum frequency. Startup tests were conducted in which the inverter frequency requirement was determined to be 270 cycles per second. Author

N70-13099# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information.
REACTOR SAFETY: A LITERATURE SEARCH
Henry D. Raleigh, comp. May 1969 155 p refs
(TID-3525-Rev-5-Suppl-4) Avail: CFSTI

Included are 725 citations to references on safety aspects of nuclear reactor design, siting, materials, engineered safeguards, and operating procedures covering the period from January 1967 through December 1968. Reports cited concern hazards analyses of entire facilities to satisfy construction and operation permit requirements, evaluation of reactor systems and components reliability, and analyses of the consequences of potential accident conditions. Subject, author, corporate author, and report number-availability indexes are included. Author (NSA)

N70-13188# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Progress Report, Oct.–Dec. 1968
Mar. 1969 126 p refs

(Contract AT(04-3)-189)
(GEAP-5770; QPR-15) Avail: CFSTI

Progress in the following tasks is described: reliability engineering, stress analysis, fracture mechanics, effect of Boiling Water Reactor environment, and fatigue. Fatigue investigations included work on: crack growth, crack initiation in the presence of concentration, prototype pipe fatigue testing, and cyclic strain aging. J.M.C.

N70-13208# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
DESIGN AND ANALYSIS OF CONTROL ROD DRIVE REACTOR VESSEL PENETRATIONS
I. R. Kobsa and V. R. Wetzel Nov. 1968 31 p refs
(APED-5703) Avail: CFSTI

A description of the control rod drive (CRD) penetrations for a large boiling water power reactor pressure vessel is given. Design features are summarized. Sketches show penetration fabrication sequence and stub-tube installation. Design bases for the CRD are described. Methods for stress analyses of CRD penetrations are discussed; probability of design load and ultimate capability are calculated. Results of calculations are tabulated. Calculated and experimentally-determined values for design cycles for axisymmetric socket nozzle connections are compared. Effects of residual stresses are considered. NSA

N70-13244# Gulf General Atomic, San Diego, Calif.
REACTOR REQUIREMENTS FOR FIRST GENERATION THERMIONIC NUCLEAR ELECTRIC PROPULSION
J. F. Ingber and D. T. Higdon 15 Jan. 1969 36 p refs Presented at 7th AIAA Elec. Propulsion Conf., Williamsburg, Va., 3–5 Mar. 1969 Submitted for publication
(Contract AT(04-3)-167)
(GA-9046-Rev; CONF-690319-2) Avail: CFSTI

Data are presented to show the interaction between reactor and mission requirements for first generation unmanned thermionic nuclear electric propulsion applications. A Titan 3 F/Centaur launch vehicle is assumed. Reactor lifetime requirements are given in terms of payload capability, and performance for different power levels is presented as a function of mission constraints, with major emphasis on 50 and 100 kW(e) power plants. Significant results are that thrust times or reactor full power operating times generally can be reduced by a factor of two or three from the optimum while maintaining useful payloads, and that a single power plant is applicable to a broad range of nuclear electric solar system missions with a power level that is compatible with projected space auxiliary power requirements. Author (NSA)

N70-13262# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
A GUIDE TO THE IRRADIATION OF MATERIALS IN THE REACTORS DIDO AND PLUTO, 1969
J. Bromley Apr. 1969 54 p refs
(AERE-M-2117) Avail: CFSTI; HMSO 7s

Some of the more common substances which may be safely irradiated in the routine irradiation rigs in DIDO and PLUTO are listed. Details of the safety criteria which have been used in drawing up the lists are also given. It is hoped that this information will provide a useful guide to enable decisions to be reached on the safety of irradiations which have not so far been considered. Typical examples of unusual irradiations which have been performed by special arrangements are included. Author (NSA)

N70-13281# Battelle-Northwest, Richland, Wash. Reactor Physics Dept.
REACTOR PHYSICS Quarterly Report, Apr.–Jun. 1969
Aug. 1969 114 p refs
(BNWL-1150) Avail: CFSTI

Progress in the following tasks is reported: the measurement of poisoned and unmoderated plutonium oxide assemblies; the effects of plutonium oxide composition on the measurement of unreflected and water reflected plutonium oxide-uranium oxide spherical assemblies; optimum fuel management scheme calculations for the fast test reactor (FTR); coolant flow rate calculations for the FTR core; calculations of optimum FTR core fluid flow; comparison of multigroup cross section codes and reactor codes for plutonium recycle test reactor(PRTR); error analysis of computer codes of fuel burnup calculations for the PRTR; and digital computer programs for physics studies on reactors. Summaries on physics studies on fast and thermal reactors are included. M.H.E.

N70-13286# Ceskoslovenska Akademie Ved, Rez.
INFLUENCE OF THE PARTLY DROPPED CONTROL ROD ON THE TEMPERATURE REGIME OF SURROUNDING FUEL ELEMENTS
J. Pfann May 1969 33 p refs In Czechoslovakian
(UJV-2166-R) Avail: AEC Depository Libraries

The ALGOL computer code for the investigation of partly dropped control rod effects on fuel element temperature distributions is described. The program makes possible the calculation of the axial temperature distribution in fuel, cladding and coolant, and changed distribution of heat sources and coolant pressure. The effects of the control rod dropped in various depths in the active core at full and reduced coolant flow rate can be examined. The demand to regain the original maximum cladding temperature at lower heat power is the criterion for the flow rate reduction. The code is used for the Bohumice Power Reactor active core investigation. Author (NSA)

N70-13287# Atomic Energy Commission, Washington, D.C. Office of the Assistant General Manager for Reactors.
NUCLEAR REACTORS BUILT, BEING BUILT, OR PLANNED IN THE UNITED STATES AS OF 30 JUNE 1969
[1969] 34 p
(TID-8200-Rev-20) Avail: CFSTI

A complete revised listing is presented for all reactors in the U.S. and all reactors manufactured by U.S. companies which have been exported. The name of the reactor is listed with location, principal nuclear contractor, type of reactor, power, and startup date. Reactors are organized by: civilian reactors, production reactors, military reactors, and reactors for export. NSA

N70-13299# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
THORIUM FUEL CYCLE DEVELOPMENT STUDIES Progress Report
R. E. Blanco, R. G. Wymer, J. D. Sease, A. L. Lotts, and R. E. Brooksbank Aug. 1969 21 p
(Contract W-7405-eng-26)
(PB-185358; ONRL-TM-2670; PR-1) Avail: CFSTI CSCL 18J

The paper is the first in a series of monthly reports which will give the progress on programs relating to the thorium-233 fuel cycle. The programs, which are almost solely directed toward application in high temperature gas cooled reactors include head-end processing, refabrication development, and irradiation testing of fuels. Author (USGRDR)

N70-13307# Bristol Aerojet, Ltd., Banwell (England).
IRRADIATION TESTING EQUIPMENT
H. E. Tilbe 1968 19 p refs Presented at the Brit. Nucl. Forum and Deut. Atomforun Meeting, Frankfurt Am Main, 15 Oct. 1968
(CONF-681064-6) Avail: AEC Depository Libraries

Irradiation experiment requirements for nuclear power stations are outlined, and the development of in-pile heaters, high temperature thermocouples, boiling water loops, and uni-axial creep and stress rupture rigs is described. Author (NSA)

N70-13311# Gulf General Atomic, San Diego, Calif.
FAST REACTOR SPECTRUM MEASUREMENTS Technical Summary Report, 1 May 1968 – 31 Jan. 1969
C. A. Preskitt, P. D'Oultremont, J. C. Young, and J. M. Neill 28

Mar. 1969 100 p refs
(Contract AT(04-3)-167)
(GA-9259) Avail: CFSTI

Three assemblies were studied in the Subcritical Time-of-Flight Spectral Facility (STSF). These included a small assembly of BeO, U-235 and U-238 designed for an integral measurement of alpha for Pu-239 and two large assemblies with compositions typical of dilute-oxide-fueled LMFBR's. The latter assemblies were zoned configurations with central zones identical to Assembly 6 of ZPR-6. The zoned configuration studied in the STSF was identical in loading to Assembly 19 of ZPR-9, one of a series of cores used to study the physics of zoned fast assemblies. New and more accurate data reduction techniques have been applied to data obtained on the U-235-graphite assembly studied as the first loading of the reactor. A substantial analytical effort has been applied to the program. This has included considerable detail work on the calculation of spectra for the cores studied as well as a concentrated effort to develop a new technique for performing resolution corrections to time-of-flight data. Particular interest is attached to the large oxide assemblies studied. Author (NSA)

N70-13337# Argonne National Lab., Ill.
THE ATTACK ON THE CLADDING OF EBR-2 DRIVER FUEL ELEMENT C-249-16
W. E. Ruther, T. D. Claar, and S. Matras. Mar. 1969 19 p
(Contract W-31-109-eng-38)
(ANL-7537) Avail: CFSTI

An investigation was made to determine the cause of grain-boundary attack in selective areas of the Type 304L stainless steel cladding of a driver fuel element removed from EBR-II. A hypothesis that improper cleaning techniques may have caused the damage was rejected after variations of normal cleaning methods failed to duplicate the phenomenon. Chemical and electron microprobe analyses, along with metallographic work, indicated that an increase in carbon concentration was associated with the areas of selective attack. Further testing showed that the microstructure of a stainless steel surface that had been intentionally contaminated with a carbonaceous substance before exposure to sodium was essentially the same as the microstructure of the cladding that had been exposed in EBR-II. Author (NSA)

N70-13362# Mitsubishi Heavy-Industries, Ltd., Tokyo (Japan).
EFFECTS OF NEUTRON IRRADIATION ON THE IMPACT PROPERTIES OF WELDED JOINT OF HEAVY THICKNESS Mn-Mo-Ni STEEL PLATE FOR NUCLEAR REACTOR VESSELS
Hiroshi Susukida (Kobe Tech. Inst.) and Tomozumi Ando (Kobe Tech. Inst.) Oct. 1968 9 p refs
(PB-185744; MTB-55) Avail: CFSTI CSCL 18H

The paper reports an experimental study on the effects of neutron irradiation in the Charpy V impact properties of welded joint of heavy thickness Mn-Mo-Ni steel plate welded and stress relieved under the same conditions as in the fabrication of actual nuclear reactor vessels and as a result, confirmed that the welded joint has superior properties for use as material for nuclear reactor vessels. Author (USGRDR)

N70-13378# Sandia Corp., Albuquerque, N.Mex. Aerospace Nuclear Safety Dept.
AEROSPACE NUCLEAR SAFETY PROGRAM Quarterly Report, 1 Apr.–30 Jun. 1969
R. G. Illing, comp. Jul. 1969 30 p
(SC-PR-69-434) Avail: CFSTI

Safety design specifications were prepared for the Transit heat source. Terminal velocities were calculated for an unablated hexagonal fuel block proposed for the Transit mission; terminal velocities and trajectories were calculated for four drop test configurations fuel blocks and fuel capsules. Droptests of four Pioneer heat source shapes were performed; the data are being reduced. One temperature response of the Apollo Lunar Radioisotopic Heater (ALRH) after earth burial was determined. A trajectory was computed for the GLFC multiple-orbit problem; the TTA computer program indicated that the GLFC would re-enter on the 22nd revolution. Author (NSA)

N70-13385# Public Health Service, Las Vegas, Nev. Southwestern Radiological Health Lab.
OFF-SITE SURVEILLANCE FOR THE PHOEBUS 1B, EP-1, EP-2, EP-3, EP-4 REACTOR TEST SERIES
Jul. 1969 38 p refs
(SWRHL-45-R) Avail: CFSTI

The Phoebus 1B reactor test series consisted of three calibration operations and a full power run. Effluent from the Experimental Plan III(EP-III) operation was detected off-site by one ground monitor. Effluent from the Experimental Plan IV(EP-IV) operation was detected in air, milk, and vegetation samples and by portable and fixed radiac instruments. The maximum concentration of I-131 in milk was 63 pCi/l. No fresh fission products were found in water samples. In addition to the usual gaseous effluent from a reactor operation, the EP-IV operation resulted in the release of discrete particles of material that were found downwind as far as 80 miles from Test Cell C. This particle had a beta plus gamma reading of 7 mR/hr as measured with an E-500B survey instrument at approximately 1-inch above the ground. This particle was collected at about H + 48 hours. Author (NSA)

N70-13388# Bettis Atomic Power Lab., West Mifflin, Pa.
ZIRCONIUM AS MATERIAL FOR THE REACTOR CORE
Ulrich Roesler et al [1968] 22 p refs Transl. into ENGLISH from Siemens Z. (Erlangen), No. 42, 1968 p 44–50
(WAPO-TRANS-119) Avail: CFSTI

A review of the development and properties of Zr and its alloys for reactor uses is presented. Included are discussions of Zr alloy uses in water-cooled reactors, corrosion and water sorption, mechanical properties, and diffusion of oxygen in the metal. Author (NSA)

N70-13396# Idaho Nuclear Corp., Idaho Falls. National Reactor Testing Station.
SUBASSEMBLY TEST PROGRAM OUTLINE FOR FY 1969 AND 1970
J. E. Grund, R. L. Johnson, K. O. Johnson, R. W. Miller, R. T. Johnson et al Aug. 1969 175 p refs
(Contract AT(10-1)-1230)
(IN-1313; IDO-17277) Avail: CFSTI

The subassembly test program in the Spert 4 capsule driver core for FY 1969 and 1970 is outlined. Basic program objective is to provide the AEC and reactor vendors with experimental information on reactor fuel behavior under transient overpower conditions. Test plans for unirradiated and irradiated (burnups to 30,000 MWd/T) UO2 fuels, Pu recycle fuels, and LMFBR fuels are presented. Data of particular interest include failure modes and thresholds, conversion efficiencies of nuclear-to-mechanical energy, transient pressures, and metal-water reaction extents, all as functions of transient energy deposition for a variety of fuel design parameters, burnup, and environmental conditions. Author (NSA)

N70-13421# Pennsylvania State Univ., University Park. Dept. of Nuclear Engineering.
STUDY OF NEW PROTECTIVE SYSTEM DESIGN TECHNIQUES FOR APPLICATION IN NUCLEAR REACTOR PLANTS, VOLUME 1
M. A. Schultz and G. C. Geisler 31 Mar. 1969 64 p refs
(Contract AT(30-1)-3986)
(NYO-3986-1-Vol-1) Avail: CFSTI

The results of a search of the aerospace literature for concepts which could prove useful in reactor protective systems are

presented. The unclassified literature in this area was scanned, and from several hundred thousand items approximately 3000 were selected for further investigation. Over 200 items were selected for detailed study. An analysis and commentary resulting from this study is given. Also for purposes of comparison, a discussion of current design techniques in nuclear protective systems is presented. Using the results of the literature search, a block diagram of a hypothetical reactor protection system is presented, as it might appear if produced by aerospace technology. Four active channels are used to monitor each plant parameter. The four channels are interconnected by voting elements between each major block in the series connected channels. Thus, any fault in a circuit or voter is cleared when the next voter is reached. Author (NSA)

N70-13432# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR DEVELOPMENT PROGRAM Quarterly Report, Feb. – Apr. 1969
G. R. Pflasterer, comp. and R. A. Becker, comp. May 1969 18 p
(Contract AT(04-3)-540)
(GEAP-10010; QR-20) Avail: CFSTI

Gas-pressure measurement techniques for SEFOR fuel rods are described. Fabrication of SEFOR thermocouple containing fuel rods is also described. The SEFOR startup testing and transient testing programs are reviewed. Operations and construction tasks completed during February to April 1969 are listed. NSA

N70-13443# Douglas United Nuclear, Inc., Richland, Wash.
N-REACTOR CONFINEMENT SYSTEM SAFETY ANALYSIS. INTERIM REPORT ON FOG SPRAY RELIABILITY
D. E. Cole 10 Jul. 1969 24 p
(DUN-5890) Avail: CFSTI

An analysis is being made of the reliability of the N-reactor confinement system to control a fission product release that could result from a nuclear safety incident. Interim results are presented on the reliability of the fog spray subsystem, an independent portion of the confinement system. The analysis employs fault tree techniques to describe system failure conditions and a Monte Carlo simulation computer program to evaluate the fault tree. The subsystem and component failure combinations that will result in insufficient fog spray protection under incident conditions are described. Seven comparative analyses were made and results on the reliability for each set of conditions are tabulated. NSA

N70-13444# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM COMPONENTS DEVELOPMENT PROGRAM: MASS TRANSFER INVESTIGATIONS IN LIQUID METAL SYSTEMS Quarterly Progress Report, Sep. – Nov. 1968
Jan. 1969 94 p refs
(Contract AT(04-3)-189)
(GEAP-5719; QPR-7) Avail: CFSTI

Activities in programs to determine corrosion and mass transfer rates under conditions of interest in the design of large LMFBR systems and FFTF are reported. Data and information resulting from operation of corrosion loops 8 and 9 are presented. Materials exposed in these runs, which were conducted using Na at 1300, included Types 304, 316, and 347 stainless steel and Incoloy 800. Research directed toward a method of determining the levels of impurities in sodium which affect corrosion mechanisms is also reported. Efforts during the report period were devoted to establishing temperature profiles, analyses of plugging indicator data, and overall loop performance experience. Other work is reported on mechanical limits for cladding materials including Types 304, 316, and 347 stainless steel and Incoloy 800. Author (NSA)

N70-13483# Kernforschungsalage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
ON THE COATING OF SPHERICAL URANIUM, THORIUM DIOXIDE PARTICLES BY PYROLYTIC CARBON THROUGH METHANE DECOMPOSITION IN 1 INCH FLUIDIZED BED [UEBER DIE BESCHICHTUNG KUGELFOERMIGER (U, TH)O-2-TEILCHEN MIT PYROLYTISCHEM KOHLENSTOFF DURCH METHANZERSETZUNG IM 1 ZOLL-FLIESSBETT]
E. Gyarmati and H. Nickel Aug. 1969 43 p refs In GERMAN
(JUL-615-RW) Avail: CFSTI

The deposition of pyrolytic carbon on (U,Th)O2-fuel kernels in a 1-inch-fluidized bed varying the methane-concentration and the deposition temperature gave the following results: (1) Pyrocarbon with laminar structure results up to deposition temperatures of 1400 C. Density and Bacon-Anistropy Factor (BAF) decrease with increasing methane-concentration, whereas the crystallite size and the efficiency decrease; (2) pyrocarbon with isotropic structure is deposited at temperatures > or = to 1400 C and methane-concentrations > or = to 15 vol-percent. A typical feature of this pyrocarbon species is the low orientation of the crystallites. With increasing temperature crystallite size, density and efficiency grow. At about 1500 C density, crystallite size and BAF reach a minimum; and (3) pyrocarbon with granular or columnar structure results at temperatures > or = to 1500 C at methane concentrations < or equal to 15 vol-percent. A significant feature of this structure is the granulation or the cone array of the deposited pyrocarbon. Density, crystallite size and BAF increase with increasing temperature. Author

N70-13503# General Electric Co., San Jose, Calif.
DESIGN AND PERFORMANCE OF GENERAL ELECTRIC BOILING WATER REACTOR MAIN STEAM LINE ISOLATION VALVES
D. A. Rockwell and E. H. van Zylstra Mar. 1969 137 p refs
Prepared jointly with Commonwealth Edison Co.
(APED-5750) Avail: CFSTI

The results of an extensive test program on the basic design of the large main steam line isolation valves use in commercially available boiling water reactors are given. Effects of mass flows, mixture qualities, and closing times were tested under coolant loss accidents. Design drawings of the commercially available large valves, used for isolation, are shown. The valve testing program is described. Data are shown graphically and in tabular form. NSA

N70-13505# Vickers-Armstrongs Aircraft, Ltd., Swindon (England). Radiation and Nuclear Engineering Div.
APPLICATIONS OF LINEAR ACCELERATORS IN NUCLEAR INDUSTRY
Maurice G. Kelliher [1968] 14 p Presented at Brit. Nucl. Forum and Deut. Atomforum Meeting, Frankfurt am Main, 15 Oct. 1968
(CONF-681064-3) Avail: AEC Depository Libraries

The applications of electron accelerators discussed are the determination of neutron capture and scattering spectra of materials, the effects of high gamma doses on materials, and the X ray examination of thick pressure vessels. The layouts of some installations are illustrated. NSA

N70-13529# Combustion Engineering, Inc., Windsor, Conn. Nuclear Power Dept.
BURNABLE POISON ADDITIONS TO UO SUB 2 Summary Report, 1 May 1967 – 30 Jun. 1968
M. G. Andrews, W. C. Taylor, and G. Zuromsky Mar. 1969 62 p refs
(Contract AT(30-1)-3107)
(CEND-3107-351; EURAEC-2123) Avail: CFSTI

One of the means by which burnable poisons can be used for reactivity control in power reactors is to add controlled amounts of a poison directly to the fuel material as a homogeneous dispersion. The addition of boron to UO sub 2 has been limited by the lack of a suitable fabrication technique which would produce the desired properties in the fuel. Activities in a program to develop the sintering techniques capable of incorporating approximately 400 ppM of natural boron in UO sub 2 pellets and to attain sintered densities in excess of 90 percent of theoretical are reported. B sub 4C was added to UO sub 2 and sintered in argon, hydrogen

(argon-10 wt % H sub 2), vacuum, and CO sub 2 – CO environments at temperatures up to 1600 C. Pellets prepared from essentially stoichiometric UO sub 2, containing 13 ppM boron in the form of B sub 4C, retained 60 to 75 percent of the boron when sintered in argon or in vacuum. Author (NSA)

N70-13540# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
INFLUENCE OF SMALL CHANGES IN THE GEOMETRY IN A TUBULAR FUEL ELEMENT ON THE TEMPERATURE DISTRIBUTION [VLIV MALYCH ZMEN GEOMETRIE TUBKOVEHO PALIVOVEHO CLANKU NA PRUBEH TEPLOT]
P. Pecha Apr. 1969 18 p refs In CZECHOSLOVAKIAN
(UJV-2154) Avail: AEC Depository Libraries

The influence of small changes in the tubular fuel element geometry is investigated (supposing the axial symmetry of the fuel element is conserved). The effects of changes of individual dimensions (external and inner radius of the U tubes, external and inner thickness of the canning material, and inner radius of the U tubes, external and inner thickness of the canning material, and inner radius of the Zr supporting tube) are estimated separately, and the total effect is considered. The extent of geometry changes in which assumption of cumulative effects can be used is discussed. The main purpose of the discussion is to give the basis of manufacturing tolerances of fuel elements composed of two U tubes. Author (NSA)

N70-13574# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Reaktorexperimente.
LOW PRESSURE CLOUD CHAMBER STUDY ON NEUTRON ENERGY DISTRIBUTION OF REACTOR BEAM TUBE IN THE REGION OF 10 KeV TO 1.8 MeV [UNTERSUCHUNG DER ENERGIEVERTEILUNG DER NEUTRONEN AM STRAHLROHR EINES REAKTORS MIT EINER NIEDERDRUCKNEBELKAMMER IM BERICH VON 10 KeV BIS 1.8 MeV]
Herbert Lang Jul. 1969 88 p refs In GERMAN
(JUL-599-RX) Avail: CFSTI

An automatically controlled low pressure cloud chamber was used to determine the energy spectra of a collimated neutron beam in the region of 10 keV to 1.7 MeV. Injected neutrons from a reactor scattered on hydrogen and their energy was determined from the energy of recoil protons and their scattering angles. Low gas pressures of 50 Torr made it possible to obtain measurements up to 10 keV. Maximal values at about 27 keV and 70 keV were attributed to minimum effective cross sections of the aluminum drift guide on the rim of the reactor core. Transl. by G.G.

N70-13585# Mitsubishi Heavy-Industries, Ltd., Tokyo (Japan).
EFFECTS OF NEUTRON IRRADIATION ON THE IMPACT PROPERTIES OF WELDED JOINT OF Ni-Cr-Mo HIGH STRENGTH STEEL PLATE FOR NUCLEAR REACTOR VESSELS
Hiroshi Susukida and Tomozumi Ando Oct. 1968 9 p refs
(PB-185745; MTB-56) Avail: CFSTI CSCL 18J

An experimental study was made on the effects of neutron irradiation (irradiation temperature 75C, neutron dose: 3.1 approximately 3.2 $\times$ 10 to the 19th power nvt, > 1 MeV) on the Charpy 5 impact properties of welded joint of Ni-Cr-Mo high strength steel plate (modified HY 80) and obtained the following results. The transition temperature TR35 of the welded joint after the neutron irradiation showed an increase of 165C in the weld metal, an increase of 138C in the bond and an increase of 149C in the heat-affected zone over their respective temperatures before the irradiation. These increases are almost equal to those in the base metal. USGRDR

N70-13586# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
PERFORMANCE EVALUATION OF HEAT EXCHANGERS FOR SODIUM-COOLED REACTORS Final Status Report
K. Goldmann, S. L. Israel, and D. J. Nolan Jun. 1969 312 p refs
(Contract AT(11-1)-1452)
(UNC-5236) Avail: CFSTI

Results of evaluation of ALCO and B & W heat exchanger data are presented. The evaluation was carried out to establish the thermal and structural performance performance of each unit. Design methods are also evaluated. NSA

N70-13595# Battelle-Northwest, Richland, Wash. Engineering Dept.
EVALUATION OF TECHNIQUES FOR THE CONTROLLED ADDITION OF IMPURITIES TO FFTF CLOSED LOOPS
J. J. Mc Cown Aug. 1969 15 p refs
(Contract AT(45-1)-1830)
(BNWL-1130) Avail: CFSTI

One of the most important variables in the FFTF closed loop testing program will be coolant purity, since variations in impurity levels could significantly alter long term test results. It will probably be necessary, therefore, not only to monitor the impurity levels but to adjust them by controlled concentration changes to meet the needs of various tests. It is concluded that methods are available for adding known amounts of oxygen and hydrogen to Na systems. In the case of carbon, it has been demonstrated that addition methods can increase the concentration for some carbon species such as cyanide and carbide. The total carbon content or carburization potential value for a system can be shifted by addition techniques but cannot necessarily be adjusted to a predetermined value. Author (NSA)

N70-13615# Battelle-Northwest, Richland, Wash.
DISTRIBUTION, ATMOSPHERIC TRANSFER, AND BALANCE OF KR-85
Raymond Pannetier (Ph.D. Thesis) 1 Jul. 1969 198 p refs Transl. into ENGLISH from French report CEA-R-3591
(BNWL-Tr-34; CEA-R-3591) Avail: CFSTI

Techniques for sampling and measuring Kr 85 were developed which allowed the determination of its geographic distribution. From its use as a tracer, an evaluation of the air masses which cross the subtropical fronts were derived, and the stratospheric character of air pollution by Kr 85 at the level of the Antarctic soil was evaluated. Levels of Kr 85 seem to point to an underestimation of the assessment of nuclear explosion fission energies as adopted by the United Nations Scientific committee on the effects of atomic radiation and emphasize the need to set limits as soon as possible on the amounts of Kr 85 released to the atmosphere by fuel-processing plants. Author (NSA)

N70-13663# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
NUCLEAR SAFETY FOR TRANSPORT FLASK IN ESSOR IRRADIATED FEEDING FUEL ELEMENTS [SECURITE NUCLEAIRE DU CHATEAU DE TRANSPORT POUR ELEMENTS NOURRICIERS ESSOR IRRADIES]
R. Ricchena and P. Rocco Sep. 1969 34 p refs In FRENCH; ENGLISH summary
(EUR-4382-f) Avail: CFSTI

This report deals with criticality calculations for the transport flask of the feeding fuel elements irradiated in the ESSOR reactor. Calculative hypotheses used to evaluate the reactivity of fissile elements are completed with other hypotheses coming from the experience of the nuclear safety problem. Two verifications were done by using: (1) the multigroup transport theory; and (2) the two-group method with band calculation on the effective Kelvin and evaluation of the microscopic cross section on the effective neutron

spectrum of equilibrium. Results of the two verifications agreed and showed the safety of the ensembly in accident conditions. An additional calculation was made to control the variation of reactivity for an increase of the pitch and diameter of the element housings. It was shown that as a consequence of this modification, the reactivity of the system decreased. Author

N70-13675# Douglas United Nuclear, Inc., Richland, Wash.
IRRADIATED FUEL EXAMINATION AND MEASUREMENT
K. B. Sowa 27 Aug. 1969 11 p Presented at Symp. on Develop. in Irradiation Testing Technol., Sandusky, Ohio
(Contract AT(45-1)-1857)
(DUN-SA-108; CONF-690910-2) Avail: CFSTI

Two methods for underwater dimensional measurement of irradiated fuel elements at Hanford are described including optical comparators and hydraulic gaging. NSA

N70-13697# Arizona Univ., Tucson. Dept. of Nuclear Engineering.
DYNAMICS OF A FAST REACTOR WITH IN-CORE THERMIONIC CONVERTERS Annual Report, 1 Sep. 1967 - 31 Aug. 1968
R. L. Brehm, D. L. Hetrick, J. G. Guppy, K. D. Kearns, and T. R. Schmidt Nov. 1968 100 p refs
(Contract AT(04-3)-670)
(TID-25121; AR-2) Avail: CFSTI

The dynamic behavior of space reactors utilizing in-core thermionic diodes is investigated. Areas of study include: the detailed developement of the two-region stability model; the development of a computer program describing an in-core thermionic reactor system in detail; and generalized studies in nonlinear reactor dynamics with parplication to the two-region model of the thermodynamic reactor. NSA

N70-13731# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
SUMMARY OF RESULTS OBTAINED FROM A TYPICAL STARTUP AND POWER TEST PROGRAM FOR GENERAL ELECTRIC BOILING WATER REACTOR
L. A. Carmichael, D. W. Diefenderfer, C. E. Foreman, and L. H. Larson 1 Feb. 1969 176 p
(APED-5698) Avail: CFSTI

Details of the startup of the Gundremmingen Power Reactor are given. The sequential guide for power testing is listed; startup organization and responsibilities are described. Startup test results are outlined. Results of primary system vibration measurements are tabulated; results of core neutronics and systems temperature balance tests are shown graphically. Low range power monitor test results are given. Details of pressure transient tests are given; recorder traces of actual data are included. Actual data for pump and generator trip tests are shown; data on isolation transients are tabulated. Problems which developed during startup are summarized. NSA

N70-13733# Oak Ridge National Lab., Tenn.
OAK RIDGE RESEARCH REACTOR Quarterly Report, Jan. - Mar. 1969
W. H. Taber and S. S. Hurt, III 10 Jun. 1969 136 p Sponsored by AEC
(ORNL-TM-2608) Avail: CFSTI

The average power level at the ORR was 29.8 MW, while the reactor operated 87 per cent of the time. Eighteen fuel elements were declared spent during the quarter, while 25 new fuel elements were placed in service. The average burnup of the elements declared spent was 48.8 per cent. The reactor was shut down on 11 occasions, 6 of which were scheduled. Two end-of-cycle shutdowns accounted for 98 per cent of the total downtime. The chamber for the No. 1 log-N instrument channel, a dual-type chamber, failed, causing an unscheduled shutdown, and was replaced. The base plate for the No. 2 primary pump was replaced because of frequent alignment problems. The base plates for the other two primary pumps will also be replaced. A rather significant change was made in the core configuration to enhance the flux at the beam holes. This was accomplished by exchanging the isotope stringer, iodine stringer, and Be reflector from the east side of the core for fuel from the south side, thus maintaining approximately the same fuel loading. Following the core change, the flux in the fuel region of the lattice was measured; and the shim rods were calibrated. Author (NSA)

N70-13739# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.
THE MODIFICATIONS OF INTEGRAL TRANSPORT THEORY FOR FLUX CALCULATION IN HWGCR LATTICE CELL
Miroslav Lehmann Mar. 1969 24 p refs
(ZJE-50) Avail: AEC Depository Libraries

Specific modifications of integral transport method are analyzed: application of diffusion approximation of neutron flux in moderator and method of cluster fuel element homogenization. The influence of introduced simplifications on precision of solutions is determined by comparison with results of more accurate methods. 6 references. Author (NSA)

N70-13742# Oak Ridge National Lab., Tenn.
SOL-GEL PREPARATION OF SPHERES: DESIGN AND OPERATION OF FLUIDIZED BED COLUMNS
Paul A. Haas Sep. 1969 66 p refs
(Contract W-7405-eng-26)
(ORNL-4398) Avail: CFSTI

These processes involve the continuous operation of fluidized bed columns in which sol drops are converted to gel spheres by extraction of water. Available information for designing and operating fluidized bed columns is summarized; emphasis is on variables other than the sol characteristics. Among the problems considered are: premature discharge of incompletely gelled particles from the sphere forming column, formation of nonspherical gel particles, and capacity limitations of the equipment. Successful continuous operation requires control of the composition of the fluidizing mixture by the addition of surfactants and the operation of a still to remove water. Capacities under normal conditions, in terms of grams of oxide spheres per hour, are estimated to be from 100 g/hr for dilute sols, using a 1-in.-ID (minimum) column, to 9000 g/hr for concentrated sols, using a 3-in.-ID (minimum) column. The dispersion of sol into uniform drops is also important to continuous and efficient operation; four useful dispersion techniques are described. Author (NSA)

N70-13748# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
THEORETICAL AND EXPERIMENTAL STUDY OF A FAST SUB-CRITICAL ASSEMBLY BY MEANS OF A NEUTRON SOURCE [ETUDE THEORIQUE ET EXPERIMENTALE D'UN ASSEMBLAGE SOUS-CRITIQUE RAPIDE A L'AIDE D'UNE SOURCE DE NEUTRONS]
Jean Moret-Bailly (Ph.D. Thesis--Paris Univ, 29 Oct. 1968) Sep. 1969 52 p In FRENCH; ENGLISH summary
(CEA-R-3887) Avail: CFSTI

A previous paper (CEA-R-3351) reported on theoretical studies and methods of numerical analysis concerning bare fast assemblies and this one is a continuation of the same work. The Franco-German experiment Eureca-Suak which was studied using multiplication coefficients between 0.45 and 0.95 is briefly described and it was found that the decay curves were not pure exponentials. Decay calculations were made taking geometrical effects and energy harmonics into account and good agreement was

obtained between the experimental and computed curves. The flux evolution as a function of time is shown in several curves and the separation of the decay curve into a set of exponentials shows the complexity of the phenomena. Author (ESRO)

N70-13749# California Univ., La Jolla.
APPLICATIONS OF STATISTICAL METHODS TO NUCLEAR STRUCTURE
Jean Robert Buchler 1969 191 p refs
(Contract AT(11-1)-GEN-10)
(UCSD-10-P-11-68/69-95) Avail: CFSTI

An improved Thomas–Fermi theory is applied to nuclear structure with an energy density functional which is based on nuclear matter calculations with variable neutron excess, thus giving the theory a microscopic foundation. Both symmetry and Coulomb effects are treated properly. The only phenomenological parameter which enters the theory is adjusted so as to give the correct binding energies over a whole range of nuclei and its value is consistent with a theoretical estimate by Bethe. A systematic study of spherical nuclei was made over a whole range of A and Z. Binding energies and shapes (mass and charge radii and surface thicknesses) are in excellent agreement with experiment. The analysis also qualitatively confirmed the isotope shift, the parabolic dependence on Z, and lent support to the idea of a neutron halo. The statistical approach was used to derive the interaction potential between heavy ions with an application to O–O scattering. Author (NSA)

N70-13776# General Electric Co., San Jose, Calif. Nuclear Fuels Dept.
POWER REACTOR HIGH PERFORMANCE UO SUB 2 PROGRAM Final Report, 1 Apr.–30 Jun. 1969
S. Y. Ogawa, comp. and M. F. Lyons, comp. Jun. 1969 31 p
(Contract AT(04-3)-189)
(GEAP-10042; EURAEC-2121; PR-10) Avail: CFSTI

A summary of activities during the entire program extending from 1966 to 1969 is presented. The objective of the program is to operate a significant number of UO sub 2 fuel rods with various degrees of central melting at rated power to high burnup in a commercial power reactor core. A chronology of activities is presented along with a list of prior reports issued. During the last quarter under the agreement, tests on Assembly D-50 were conducted. This assembly of UO sub 2 pellets was exposed at 5975 MWd/t. Results of post irradiation examination are summarized and interpretations of failure causes are offered. NSA

N70-13780# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
ANALYTICAL METHODS FOR EVALUATING THE RADIOLOGICAL ASPECTS OF THE GENERAL ELECTRIC BOILING WATER REACTOR
N. R. Horton, W. A. Williams, and J. W. Holtzclaw Mar. 1969 112 p refs
(APED-5756) Avail: CFSTI

The mathematical models and conversion factors which are used in evaluating the safety aspects of the boiling water power reactor are detailed. The following aspects of a hypothetical coolant loss accident are discussed: containment response analysis, core heatup analysis, fission product release from fuel, iodine partition and decontamination factors, fission product behavior in the primary containment, fission product activity in the primary and secondary containment, and fission product activity released to the environment. The following additional hypothetical accidents are considered: steam line break, refueling, control rod drop, fission product to the atmosphere, and radiological effects. NSA

N70-13788# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
HEAT TRANSFER COEFFICIENTS BETWEEN FUEL AND CLADDING IN OXIDE FUEL RODS
C. N. Craig, G. R. Hall, and W. E. Baily Jan. 1969 42 p refs
(Contract AT(04-3)-189)
(GEAP-5748) Avail: CFSTI

Coefficients of heat transfer between fuel and cladding were determined from in-pile irradiations. Values of 1150, 750, and 520 Btu/h-ft2-°F were obtained for initial nominal fuel-cladding gaps of 0.002, 0.004, and 0.010 inch in the power range from 17.5 to 20.0 kW/ft. Heat transfer coefficients obtained for mixed oxide fuel rods irradiated in a fast flux for burnups ranging from 1500 to 50,000 MWd/Te are also presented. Author (NSA)

N70-13814# Public Health Service, Las Vegas, Nev. Southwestern Radiological Health Lab.
PARTICULATE EFFLUENT STUDY. PHOEBUS 2A: EP-4 AND EP-5
Jun. 1969 62 p refs Sponsored by AEC
(SWRHL-60-r) Avail: CFSTI

The Phoebus 2A Experimental Plans 4 and 5 were full-power nuclear reactor operations conducted as part of Project Rover. Large effluent particles of high activity were studied for particle deposition concentration at various distances, gross physical characteristics, chemical composition, and gross and specific radioactivity. Survey results indicated wide spread deposition for Plan 4 with no defined hotline. Plan 5 survey results indicated the major deposition between 13 and 21 from Test Cell C. The particles were porous and fragile and had a metallic black appearance. Sizes ranged from eight to 200 micrometers on Plan 4 and seven to 163 micrometers on Plan 5. The use of a latex spray reduced the shattering of particles during collection and separation. The chemical composition of the particles was primarily uranium oxides. Fall velocity was determined in free air and liquid. Gross activity of the particles was 10 to the 7th power–10 to the 11th power fissions on both runs. The primary radioisotopes found by gamma spectroscopy were those of Sr, Zr, Ru, I, Ba, Mo, and Ce. Author (NSA)

N70-13839# Battelle-Northwest, Richland, Wash.
CONTINUOUS MEASUREMENTS OF DEFORMATION DURING IN-REACTOR IRRADIATION. SOME RESULTS OBTAINED BY RESONANT CAVITY
M. Masson et al 28 Jul. 1969 13 p refs Transl. into ENGLISH from the French report
(BNWL-TR-37; CEA-CONF-1117) Avail: CFSTI

The dimensional behavior of structural materials or fuels exposed to radiation results from the action of various phenomena such as creep, growth, swelling, densification, cycling, Wigner effect, etc. A device was constructed to measure directly under reactor flux and continuously the dimensional variations of samples. The method is based on the use of klystrons associated with a reference cavity or with a frequency meter. The results of measurements made on the elongation of a fuel rod, the creep of stainless steel samples, and the densification of silica were reported. The results obtained agree with measurements made on the sample after irradiation. The easy operation and relatively low cost of the apparatus make is advantageous for wide application. NSA

N70-13844# Battelle-Northwest, Richland, Wash.
PLUTONIUM UTILIZATION PROGRAM Technical Quarterly Report, Mar.–May 1969
Jul. 1969 70 p refs
(Contract AT(45-1)-1830)
(BNWL-1106) Avail: CFSTI

Progress in fuel development and reactor physics is reviewed. Topics discussed under fuel development are: high exposure plutonium research, gas pressure measuring experiment, in-reactor fuel temperature measuring experiment, high power density fuel irradiations in the plutonium recycle test reactor, and transient testing. Topics included under reactor physics are: theoretical correlation of

the plutonium recycle test reactor batch core experiment, experiment-theory correlation of the ratio of the effective delayed neutron fraction to mean neutron lifetime, revision of FLARE (BRE-1), intermediate resonance of approximation in HRG, analytical correlation of measured power distribution, measurement of the temperature coefficient of reactivity using the endogenous pulsed source method, and the determination shape of peaks in gamma ray spectra from Ge (Li) detectors. J.M.C

N70-13887# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
REPROCESSING OF IRRADIATED FUELS Final Report
Aug. 1969 115 p refs
(Contracts EURATOM-006-65-7-RCLB; EURATOM-016-65-1-RAPB)
(EUR-4009-e) Avail: CFSTI

The present report contains the highlights from basic and conceptual studies and cold and hot technology experiments. The reaction mechanism of ClF3 and ClF with UO2-PuO2 oxide mixtures has been investigated as a function of temperature, gas and fuel composition. The decreasing sphere model can be applied to the ClF3 reaction which also performs at high speed even with (U-Pu)O2 solid solutions. The monofluoride (ClF) on the contrary can be considered as a selective fluorinating agent for UF6, but its lower reactivity requires much higher reaction temperatures (450 C). Cold technology problems on chemical decladding of stainless steel canned UO2 fuel using HF + O are briefly mentioned. Results from the volatilization of UF6 in fluidized packed-bed reactors are listed. The reaction rates and efficiencies in large columns of various fluorinaturing gases are discussed and compared. A description of the E.B.O.–U.T.A. installation is given. Results from the semi-hot SPu facility, concerning the UF6 volatilization rates with ClF3 on UO2-PuO2 pellets, are discussed, also simultaneous removal of Pu either by volatilization of PuF6 with F2 or by elutriation of Pu containing fines is reported. The equipment of the alpha and gamma facilities has been completed and is considered as operational. The conceptual design work has been devoted essentially to the study of mechanical decanning. Author

N70-13963# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
GEL-ADDITION PROCESS CHEMICAL STUDIES Quarterly Progress Report May–Jul. 1969
R. V. Carlson, comp. Sep. 1969 14 p refs
(Contract AT(30-1)-3714)
(BAW-3714-14; QPR-12) Avail: CFSTI

The development of a sol-gel process and related processes for preparing (U, Pu)O2 fast reactor fuels has continued. The preparation of UO2–20% PuO2 fuel in the form of sol-gel microspheres and coprecipitated power for thermal rector testing was completed. Preparation of fuel containing 20% PuO2 in UO2 enriched to 93% U-235 for irradiation in the fast reactor conditions obtainable in EBR-2 was initiated. The seventh capsule in a series designed to show the differences in restructuring kinetics of pellets and vibratory compacted spheres and shards was irradiated in the BAWTR. The linear heat rate was about 18.5 kW/ft, and the exposure time was 1 EFPD. This capsule, as well as the six that were irradiated previously, is cooling pending hot cell examination. Author (NSA)

N70-13995# Bettis Atomic Power Lab., Pittsburgh, Pa.
BEHAVIOR OF AN INTENTIONALLY DEFECTED FUEL ROD WHICH RUPTURED DURING IRRADIATION (ROD BETT 79-84-D): LWBR DEVELOPMENT PROGRAM
B. A. Hersey and H. B. Meieran Jul. 1969 90 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-628) Avail: CFSTI

An intentionally defected Zircaloy–4 clad ceramic pelleted fuel rod was irradiated in the ETR reactor L-12 loop to a depletion of 8 × 10 to the 20th power fissions/cc. This rod was intentionally defected with a 0.0062-inch diameter defect hole located near the top of the rod. The ZrO2 + 29.6 wt % UO2 fuel material in this rod was in the form of combined-void-volume pellets. The rod failed after 121.2 EFPD of test operation. The purpose of the defect hole was to provide information regarding the effect of defect operation on the performance of a fuel rod with respect to cladding stability, waterlogging potentials, hydrogen pickup in the cladding, and corrosion behavior of an irradiated ceramic fuel material. The post-irradiation examination of this rod and evaluation of its irradiation behavior are described. Author (NSA)

N70-14003# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
IRRADIATION OF MIXED UO SUB 2-PuO SUB 2 OXIDE SAMPLES FOR FAST NEUTRON REACTOR FUEL ELEMENTS [RESULTATS D'IRRADIATION D'ECHANTILLONS EN OXYDE MIXTE UO SUB 2-PuO SUB 2 POUR ELEMENTS COMBUSTIBLES DE REACTEURS A NEUTRONS RAPIDES]
Hubert Mikailoff, Jean-Pierre Mustelier, Jacqueline Bloch, Madeleine Conte, Lucien Hayet et al Oct. 1969 70 p refs In FRENCH; ENGLISH summary Prepared jointly with EURATOM
(CEA-R-3878; EUR-4323-f) Avail: CFSTI

Thermal flux irradiation testings of small mixed oxide pellets UO sub 2-PuO sub 2 fuel elements were performed in support of the fuel reference design for the Phenix fast reactor. The effects of different parameters such as stoichiometry, pellet density and pellet clad gap on the behaviour of the oxide, temperature distribution, microstructural changes and fission gas release were investigated in various irradiation conditions. The effect of fuel density decrease and power rate increase on thermal performances were determined on short term irradiations of porous fuels. Author (ESRO)

N70-14011# Scientific Translation Service, Ann Arbor, Mich.
STUDY OF VOLATILITY PROCESSING METHODS Semiannual Report, Dec. 1967–May 1968
Jun. 1969 31 p ref Transl. into ENGLISH from CEA-N-1044, Chapter 9, Dec. 1968 p 244–268 Prepared for ANL
(ANL-Trans-751; CEA-N-1044; SAR-5) Avail: CFSTI

Methods for the volatilization of Al–U, U–Zr, and PuO2–UO2 fuels are described. Special attention was given to the kinetics of UO2 fluorination by BrF5 and NpF4 by F. The results of thermal decladding tests on reactor fuel elements are also reported NSA

N70-14065# Oak Ridge National Lab., Tenn.
MOLTEN-SALT REACTOR PROGRAM Semiannual Progress Report for Period Ending 28 Feb. 1969
Aug. 1969 307 p refs
(Contract W-7405-eng-26)
(ORNL-4396) Avail: CFSTI

Operational design and development work for the molten salt reactor program includes the processing and preparation of nuclear reactor fuel elements and construction materials. Emphasis is placed on the evaluation of graphite samples for their physical properties and application in reactor technology. Criticality studies are reported on uranium fueled experiments. Chemical analytical methods for molten salt reactor fuel processing and fission product determination also included. G.G.

N70-14066# Atomics International, Canoga Park, Calif.
DIFFERENTIAL NEUTRON SPECTRA IN ECEL REACTOR CORES 17 AND 17P
R. K. Paschall and R. J. Tuttle 15 Jul. 1969 28 p refs
(Contract AT(04-3)-701)
(AI-AEC-12855) Avail: CFSTI

The ECEL reactor has a fast central test region driven by an outer thermal region. The Core 17 test region is composed of U-235, U-238, C, Na, Al, and stainless steel, and had a median fission energy of 93 keV. Core 17P was formed from Core 17 by replacing the plate material in a central subzone by pin-type fuel elements. Each fuel element contained a square array of 49 pins with NaF between them; the median fission energy was 89 keV in Core 17P. Spherical proton-recoil detectors were used to measure the spectra. In Core 17, detectors were located at or near the center of the test region, and outside of the reactor, measuring the spectrum of a neutron beam emanating from the core center through an empty central drawer in one half of the reactor. In Core 17P, spectra were measured with detectors at the center of the test region as well as at 2-in. intervals along a radius out to 14 in. The similarities and differences between the two cores are discussed. Author (NSA)

N70-14068# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
STABILITY AND DYNAMIC PERFORMANCE OF GENERAL ELECTRIC BOILING WATER REACTOR
L. A. Carmichael and G. J. Scatena Apr. 1969 146 p refs
(APED-5652) Avail: CFSTI

The physical and phenomenological characteristics pertinent to stability analyses are described for the three portions of the plant evaluated in the BWR design process, i.e., total plant, core, and channel hydrodynamic characteristics. A description is given of the stability criteria and its theoretical basis followed by a description of the analytical methods used in evaluating the BWR, each method being substantiated by experimental data. Lastly, a parametric evaluation of the current BWR design is made for the total plant, reactor core, and channel hydrodynamic performance over a wide range of operating conditions. These analyses have been derived from and are supported by test data from boiling water reactors currently in operation. The detailed information presented demonstrates the technical proficiency of the design and substantiates the operational stability characteristics of the integrated nuclear steam supply system. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-12764# Oak Ridge National Lab., Tenn.
THEORETICAL ANALYSIS OF SELECTED ELECTROMAGNETIC INDUCTION PROBLEMS
Joseph Wilson Luquire, III (Ph.D. Thesis - Tenn. Univ., Knoxville) Sep. 1969 134 p refs
(Contract W-7405-eng-26)
(PB-186057; ORNL-TM-2633) Avail: CFSTI CSCL 20C

The general theory for the vector potential produced by a sinusoidal current of finite cross section is developed and applied to several different current and conductor geometries: a coil between a number of conducting plates; a coil encircling two, concentric, spherical shells; and a straight wire between a number of conducting plates. Linear, isotropic and homogeneous media are assumed throughout each analysis. In each case the Green's function solution is first obtained, and the principle of superposition then used to effect the desired result. Each case is sufficiently general to allow the solution of a considerable number of difficult electromagnetic induction problems, while each of the expressions obtained for the physically observable phenomena is in terms of an infinite integral or sum which may be readily evaluated on a computer. Author (USGRDR)

N70-12988# British Steel Corp., London (England). Scottish and North West Group.
THE EFFECT OF INTER-OCULAR DISTANCE ON THE MAGNIFICATION OF THE VICKERS M12A BINOCULAR METALLURGICAL MICROSCOPE
W. Mc Kinley and K. Randerson 1969 5 p
(PB-186167; SNW(C)J81-1) Avail: CFSTI CSCL 20F

It is shown that on many binocular microscopes, the magnification varies with the interocular distance. It is concluded that when an eyepiece micrometer is used, it must be calibrated for each interocular setting. It is also shown that the eyepiece focussing unit on a binocular microscope causes some variation in magnification. Author (USGRDR)

N70-13100# Atomic Energy Centre, Lahore (Pakistan). Library Div.
THERMOELECTRICITY: A BIBLIOGRAPHY
M. M. Rafique and M. Saleem Mar. 1969 64 p refs
(AECL-Pak-Lib-28) Avail: CFSTI

A list of 615 references to unclassified and published literature covering the period from 1957 to 1968 is presented. NSA

N70-13150# Institut Franco-Allemand de Recherches, St. Louis (France).
ATMOSPHERIC REFRACTION AND REFLECTION IN SONIC BOOMS [REFRACTION ATMOSPHERIQUE ET REFLEXION AU SOL DES BANGS]
C. Thery *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 15 p refs In FRENCH (See N70-13137 03-02)
Avail: CFSTI

A new analytical method is applied to the atmospheric refraction of weak intensity repeater shock waves. The results are in excellent agreement with the flight analysis of Jericho. Experimental shock tube studies reported here are considered less conclusive. Transl. by M.H.E.

N70-13159# National Research Council of Canada, Ottawa (Ontario). Structures Dept.
THE NEAR FIELD SOUND PRESSURES OF A CHOKED JET DURING A SCREECH CYCLE
R. Westley and J. H. Woolley *In* AGARD Aircraft Engine Noise and Sonic Boom May 1969 15 p refs (See N70-13137 03-02)
Avail: CFSTI

An experimental investigation was completed of the distribution of the instantaneous near field sound pressures during the axisymmetric search mode of a choked air jet. The data supplements a previous report by the same authors on the near field sound pressure levels and spectra of a similar jet. The investigation helps to clarify certain aspects of jet screech mechanism and provides data for predicting structural response in the near field. Author

N70-13257# Scientific Translation Service, Ann Arbor, Mich.
PROBLEM OF A SPHERE IN A HOMOGENEOUS VARIABLE MAGNETIC OR ELECTRICAL FIELD [ZADACHA O SHARE, POMESHCHENNOM, ODNORODONOE PEREMENNOE MAGNITOE ILI ELEKTRICHESKOE POLE]
M. A. Divilkovskii Jul. 1969 18 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 9, no. 5, 1939 p 433-443
Sponsored by AEC Prepared for Argonne Natl. Lab.
(PB-184912T; ANL-Trans-760) Avail: CFSTI CSCL 20C

A calculation is performed for the electromagnetic field generated when a sphere is placed into a homogeneous electrical

or magnetic field which is sinusoidal in time. Formulas are given for the power consumed in the general case and in the cases of low- and high-frequencies in a metal sphere and in a sphere made of a polar dielectric or of an electrolyte. Curves are given which show the losses for spheres of various substances placed in a variable magnetic or an electric field. It is shown that the losses in polar dielectric liquids and in electrolytes in a variable magnetic field become appreciable in the region of decimeter waves which can be utilized for measuring absorption. The electrical and magnetic moments of a sphere in a variable field are also calculated. Author (USGRDR)

N70-13377# Eppley Lab., Inc., Newport, R.I.
CONSTRUCTION AND EVALUATION OF A LOW TEMPERATURE PROTOTYPE RADIATION SOURCE, PHASE 2 Final Report, 2 Dec. 1968 – 5 Aug. 1969
A. R. Karoli 29 Aug. 1969 13 p refs
(Contract ESSA-E75-68(N))
(PB-186194) Avail: CFSTI CSCL 14B

A prototype low-temperature blackbody radiation source has been constructed and preliminary evaluation tests carried out. The design concept, employing cryogenic techniques, incorporates a liquid nitrogen reservoir in a Dewar body, as a means of providing the environment necessary to produce a blackbody with potential temperature range of −195 to +50C. Presented in this report are the preliminary test results and recommended modifications to improve the prototype system. The tests pertain to the determination of temperature distribution and operational temperature range within the zone to be occupied by the blackbody radiator. Author (USGRDR)

N70-13451# Akademiya Nauk URSR, Kiev.
CALCULATION AND MEASUREMENT OF THE INFORMATION PARAMETERS OF ELECTROMAGNETIC FIELDS
1967 166 p refs in RUSSIAN
Avail: CFSTI

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2. THE ELECTROMAGNETIC FIELD OF AN INFINITELY LONG CABLE WITH A CURRENT LOCATED ALONG THE INNER LAYER OF A CYLINDRICAL TWO-LAYERED MEDIUM V. F. Kulko, V. N. Mikhaylovskiy, and M. S. Mikhnova p 19–25 refs (See N70-13453 03-23)

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11. THE LOGARITHMIC FORM OF PRESENTING GEOPHYSICAL INFORMATION V. K. Rybin and A. P. Savin p 103–117 refs (See N70-13462 03-13)

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14. OPERATIONAL ANALYSIS OF AN EVEN HARMONICS MAGNETIC MODULATOR IN THE OVEREXCITED MODE OF ASSIGNED VOLTAGE R. Ya. Berkman and V. M. Fedotov p 133–140 refs (See N70-13465 03-09)

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16. ON CALCULATING THE FREQUENCY ERROR COMPENSATION OF HALF-WAVE RECTIFIER CIRCUITS Ye. N. Kurilov p 152–158 refs (See N70-13467 03-09)

17. ON THE PROBLEM OF PROSPECTING BY DIVINING ROD G. S. Frantov p 159–164 refs (See N70-13468 03-13)

N70-13452# Akademiya Nauk URSR, Kiev.
THE ELECTROMAGNETIC FIELD OF A HORIZONTAL ELECTRIC DIPOLE LOCATED ABOVE THE SPHERICAL INTERFACE OF TWO CONDUCTING MEDIA
V. F. Kulko and V. N. Mikhaylovskiy *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 9–18 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

The interface between the media is a sphere of a certain radius. The value of the radius is a assumed to be large (of the order of the earth's radius or greater). The electromagnetic parameters of each of the media are assumed to be arbitrary, but their conductivity is assumed to be different from zero. An electric dipole, the axis of which is oriented perpendicular to the radius of the sphere, is located on the outer layer. The intensity of the electrical and magnetic fields in each layer of the dipole emitter must be calculated. This is accomplished by using the method of spherical coordinates on the basis of formulas which present a new concept for Hankel functions. Transl. by R.B.

N70-13453# Akademiya Nauk URSR, Kiev.
THE ELECTROMAGNETIC FIELD OF AN INFINITELY LONG CABLE WITH A CURRENT LOCATED ALONG THE INNER LAYER OF A CYLINDRICAL TWO-LAYERED MEDIUM
V. F. Kulko, V. N. Mikhaylovskiy, and M. S. Mikhnova *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 19–25 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

An infinitely long cable is located in the inner layer of a cylindrical, two-layered conducting medium with an interface in the form of a cylinder of a certain radius which is assumed to be quite large. A current flows along the cable and varies harmonically in time. The intensity of the electrical and magnetic fields in each layer of the two-layered cylinder is calculated by using new derivations of Hankel functions. Transl. by R.B.

N70-13454 Akademiya Nauk URSR, Kiev.
CALCULATING THE FIELD EXCITATION OF RECTANGULAR LOOPS DURING INDUCTIVE ELECTRIC GEOPHYSICAL PROSPECTING
L. P. Dikmarova *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 26–31 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

Formulas are given for calculating the primary fields and signals in the receiver chassis, when the field is excited by an ungrounded rectangular loop. In calculating anomalous effects it is assumed that the ore body is small with respect to the chassis, that it has a regular isometric shape, and that it may be regarded as a sphere. The interference medium is assumed to be homogeneous and non-conducting. Transl. by R.B.

N70-13455# Akademiya Nauk URSR, Kiev.
ON CALCULATING THE TRANSIENT PROCESS IN THE METHOD OF FIELD FORMATION BY THE REAL PARAMETERS OF THE GENERATOR DIPOLE AND INDUCTION MAGNETOMETER
A. A. Vakulskiy and A. S. Fedchishin *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 32–41 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

When calculating by the method of field formation, expressions for the secondary field of the emf in an induction magnetometer from bodies of simple shape are generally used, making the following assumptions: 1) the body is located in a non-conducting medium; 2) it is intersected by a homogeneous primary field; 3) the receiver chassis is intersected by a homogeneous secondary field; 4) the current pulses in the generator chassis are ideally square-shaped; and 5) the emf induced by the secondary field at the point of reception is measured at the magnetometer output. A fundamental system of coordinates is coincident with the generator dipole and the dipole moment is oriented along one of the axes of this system. The moment of the induction magnetometer may also be oriented along any of the axes. A spherical, non-magnetic conducting body is situated arbitrarily with respect to the generator and receiver dipoles. On the basis of these conditions, expressions are derived for the natural transient process and useful signal by calculating the final length of the switch-off front of the current and the real parameters of the magnetometer. Transl. by R.B.

N70-13457# Akademiya Nauk URSR, Kiev.
A SURFACE TM-WAVE IN A SEMI-CONDUCTING MEDIUM
V. I. Gordiyenko *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 45–55 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

The propagation of a surface TM-wave along a conductor with a dielectric covering located in a semiconducting medium is considered. An equation is derived for calculating the constant of propagation and a method is given for finding this value. The damping coefficient and radius of field concentration are calculated. The calculations show that the damping coefficient decreased with frequency when a dielectric covering with low permeability is used, and that it also decreases with the thickness of the dielectric covering. The radius of field concentration decreases when dielectric materials with high permeability are used, as the thickness of the dielectric covering increases, and as frequency increases. Transl. by R.B.

N70-13458# Akademiya Nauk URSR, Kiev.
ENERGY RATIOS IN A SINGLE-CONDUCTOR TRANSMISSION LINE
V. I. Gordiyenko *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 56–62 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

Expressions are derived for the energy flow through circular coaxial surfaces with a cylindrical single conductor of infinite length, which are used for transmission of surface waves. A formula is given for calculating the radius of field concentration and its dependence on the frequency of the field exciter is investigated. Transl. by R.B.

N70-13459# Akademiya Nauk URSR, Kiev.
A DIFFERENTIAL DEVICE FOR DETECTING LOCAL CONDUCTING BODIES
Ye. I. Boyko *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 63–69 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

In inductive electric geophysical prospecting, secondary magnetic fields of eddy currents are measured which develop in the conducting media due to the effect of the primary magnetic field created by the source. When the receiver and generator chassis are in close proximity, the primary field greatly exceeds the secondary field and the latter cannot be measured. In order to detect an object, the primary field in the region of the receiver chassis must be either attenuated or corrected to the level of the secondary field. A device is described which consists of two pairs of integrated generator and receiver chassis which are not rigidly connected. The generator chassis are switched on in series and the receiver chassis counter to this. The location of the anomaly is determined by the difference in signals in the receiver chassis. Transl. by R.B.

N70-13463# Akademiya Nauk URSR, Kiev.
ORIENTATION ERRORS IN MEASURING THE INTENSITY COMPONENTS OF AN ELLIPTICALLY POLARIZED MAGNETIC FIELD
V. M. Podzharyy *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 118–125 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

In measuring the components of magnetic fields weakly polarized elliptically and linearly, a large proportion of errors are attributed to orientation errors caused by design imperfections of devices used to align the field receiver. These errors depend on the spatial direction of the measured component and the structure of the field itself, and in certain cases may reach unacceptable values. Errors are considered which occur due to orientation inaccuracy in measuring the moduli and phase shifts of magnetic field components, using a single oriented magnetometer, for a general case of the components in the plane of the polarization ellipse. Transl. by R.B.

N70-13464# Akademiya Nauk URSR, Kiev.
THE PHYSICAL PRACTICABILITY OF ASSIGNED FIELD CURRENT AND EXCITATION VOLTAGE MODES OF MAGNETIC MODULATORS AND THE AREA OF APPLICATION OF CORRESPONDING CALCULATING FUNCTIONS
R. Ya. Berkman *In its* Calculation and Meas. of the Inform. Parameters of Electromagnetic Fields 1967 p 126–132 refs In RUSSIAN (See N70-13451 03-23)
Avail: CFSTI

Errors which occur due to the imperfection of assigned field current and excitation voltage modes are calculated analytically for the sine- and square-wave excitation voltage curve. An area is established for application of the calculating functions for the indicated modes. It is shown that the excitation mode of real modulators is similar to assigned voltage rather than to assigned current. An approach for analysis is formulated which permits extension of the methodology developed in the literature to the overexcited mode of assigned voltage. Transl. by R.B.

N70-13758# Miami Univ., Coral Gables, Fla. Dept. of Physics.
COMMENTS ON POYNTING'S THEOREM FOR A MOVING CONDUCTING MEDIUM
Lawrence Carl Hawkins [1969] 4 p refs
(Contract AT(40-1)-3895)
(ORO-3895-3) Avail: CFSTI

Two microscopic corrections to the transport equation of electromagnetic energy (Poynting's Theorem) in a moving conducting medium, derived in a recent communication, are found to be in error. Author (NSA)

N70-13883# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.
CONTRIBUTION TO THE CALCULATION OF INTERFERENCE FIGURES OF TRICLINIC CRYSTALS WITH AND WITHOUT MAGNETISM [BEITRAG ZUR BERECHNUNG VON ACHSENBILDERN TRIKLINER KRISTALLE MIT UND OHNE MAGNETISMUS]
Dieter Pohl (Ph.D. Thesis) 1968 83 p refs In GERMAN
Avail: CFSTI

A new method for the computation of interference figures for biaxial crystals is described which is based on the simultaneous determination of the isochromatic and principal isogyric lines by means of calculating the intensity of the interference image as a function of position. This method allows the consideration also of the influence of a first order red platelet and can be extended to magnetic crystals. This is done using the ALGOL program listed in the annex. ESRO

N70-13896# National Physical Lab., Teddington (England). Div. of Optical Metrology.
THE PREPARATION OF THIN FILM POLARIZERS
P. B. Clapham Oct. 1969 226 p refs
(NPL-OP-MET-7) Avail: CFSTI

The design and manufacturing details of thin film polarizers (polarizing beam-splitters) are described. The optical theory of thin film multilayers is derived. The various design requirements of the components are considered. The practical details of the preparation are investigated in detail and two designs are examined at length. the first provides highly efficient polarizing beam-splitters without resorting to the use of either unconventional materials or methods. The second design, however, produces the highest efficiencies, but has recourse to less familiar deposition techniques. Thus, electron bombardment evaporation sources are required and quartz oscillator thickness control is used. The many problems associated with these two techniques are investigated and discussed. The measured performances of some beam-splitters are presented. In some cases polarizing efficiencies in excess of 99.8% are achieved in both reflected and transmitted beams. Finally, a selection of practical applications is described. Author (ESRO)

N70-13900# Institut d'Aéronomie Spatiale de Belgique, Brussels.
ATMOSPHERIC DENSITY VARIATIONS IN THE THERMOSPHERE [LES VARIATIONS DE LA DENSITE ATMOSPHERIQUE DANS LA THERMOSPHERE]
J. Vercheval 1969 28 p refs In FRENCH; ENGLISH summary
Presented at the Roy. Acad. of Sci. Meeting, Brussels, 4 Oct. 1969
Submitted for publication *Its* Aeronomica Acta No. A-65-1969
Avail: CFSTI

An analysis of the various types of density variations in the mean thermosphere is made by using the orbital data of the satellites 1966–101 G, Secor 6 and ERS 16 obtained between November 1966 and June 1967. Author (ESRO)

N70-13982# Interior Dept., Washington, D.C.
SOUND ABSORPTION IN POLYCRYSTALS
M. A. Isakovich 1969 10 p refs Transl. into ENGLISH from Zhurnal Eksperimentalnoi i Teoreticheskoi Fiz. (USSR) v. 18, no. 4, Apr. 1948 p 386–391
(PB-184897T) Avail: CFSTI CSCL 20A

This report presents a critique and correction of Ziner's theory on sound absorption in polycrystals. Results have been obtained which are generalized to other cases of sound absorption in a solid medium. The extents of inhomogeneities of these results are small with comparison to the length of the soundwave. Author (USGRDR)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-12706# Gosudarstvennyi Komitet po Izpolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
GENERAL SYSTEM OF THE PROTON BEAM REJECTION FROM THE ACCELERATOR OF THE INSTITUTE FOR HIGH ENERGY PHYSICS [OBSHCHAYA SKEMA VYVODA PUCHKOV PROTONOV IZ USKORITELYA IFVE]
K. P. Myznikov, Yu. M. Sapunov, V. M. Tatarenko, Yu. S. Fedotov, and A. M. Frolov 1968 20 p refs In RUSSIAN
(IFVE-SKU-68-57) Avail: AEC Depository Libraries; CFSTI (US Sales Only)

Basic principles of the rejection system for the proton beam in the experimental hall of the accelerator are described. There are three fast-rejection and two slow-rejection chambers for the protons, thus the experimental possibilities increase. Besides the possibilities of using the proton beam and the work of the channel many times per accelerating cycle are discussed. Author (NSA)

N70-12711# Scientific Translation Service, Ann Arbor, Mich.
INTERACTION CROSS SECTIONS OF NUCLEONS WITH HELIUM
V. S. Barashenko et al. Oak Ridge, Tenn. Oak Ridge Natl. Lab. [1969] 6 p refs Transl. into ENGLISH from Russian report no. JINR-P2-4333 Sponsored by AEC Prepared for Oak Ridge Natl. Lab.
(ORNL-tr-2183; JINR-P2-4333) Avail: CFSTI

The energy dependence curves of cross sections for the interaction of a nucleon with the He-4 nucleus are given. At higher energies the curves were calculated by the Glauber theory, while for the lower energies they were obtained by interpolation of known experimental data by means of optical model formulas. Author (NSA)

N70-12712# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
TWO PARTICLE QUANTUM ELECTRODYNAMICS
C. L. Hammer and D. S. Morol May 1969 11 p refs
(Contract W-7405-eng-82)
(IS-2085) Avail: CFSTI

A discussion is given of preliminary results of a field theory based on the spin 1/2 specialization of a recent manifestly covariant theory for arbitrary spin and mass. The field theory contains all the results of quantum electrodynamics including the micromeson diagrams. The mass renormalization, which is finite in lowest order, may be finite to all orders. Author (NSA)

N70-12718# Brookhaven National Lab., Upton, N.Y.
APPLICATION OF X-RAY TRANSITION RADIATION TO THE DETECTION OF SUPER HIGH ENERGY PARTICLES
Luke C. L. Yuan [1969] 13 p refs Presented at 11th Intern. Conf. on Cosmic Rays, Budapest, 25 Aug. 1969 Sponsored by AEC
(BNL-13906; Conf-690814-1) Avail: CFSTI

The development of a unique technique for detection of relativistic particles which make use of the X-ray transition radiation is described. Preliminary measurements of the transition radiation in the X-ray region produced by a 2-GeV positron beam passing through a stack of 231 aluminum foils are reported. NSA

N70-12721# Brookhaven National Lab., Upton, N.Y. Div. of Technical Information.
EFFECT OF THE OPTICAL-MODEL PARAMETERS ON CHANNEL ANALYSIS OF THE NEUTRON-INDUCED NUCLEAR FISSION
S. B. Ermagambetov May 1969 22 p refs Transl. into ENGLISH from Yadern. Fiz. (USSR), v. 8, no. 4, 1968 p 704–712 Sponsored by AEC
(BNL-tr-273) Avail: CFSTI

Sensibility of the channel analysis of the neutron-induced nuclear fission to parameters of the optical model, is discussed. It is shown that the neutron penetrability given in the atlas BNL-765, used often for channel analysis is in poor agreement with the cumulative experimental data on interactions of neutrons with nuclei. With this in view an attempt is undertaken to estimate results of preceding works critically. Author (NSA)

N70-12726# Northeastern Univ., Boston, Mass. Dept. of Physics.
VENEZIANO AMPLITUDE, CURRENT ALGEBRA AND VERTEX FUNCTIONS
P. Nath, R. Arnowitt, and M. H. Friedman (MIT, Cambridge, Mass.) Aug. 1969 30 p refs Sponsored in part by NSF
Avail: Issuing Activity

The possibility is examined of extending the Veneziano amplitudes to the case of one or two mesons off the mass shell in a fashion consistent with chiral current algebra, PCAC and CVC. Soft pion formulae for the pion vector form factor and the sigma-commutator vertex are deduced. The hard meson analysis shows that to maintain Veneziano form with two mesons off the mass shell, some of the amplitudes must develop poles in one of the off-shell momenta. The soft pion vertex function equations are seen to be a consequence of removing the leading part of this singularity at the soft pion point. However, the resultant amplitudes are still singular for a continuum of s, t and u. The fixed poles implied by the presence of form factors (when two mesons are off-shell) are seen to occur only in those amplitudes orthogonal to the polarization vector and do not affect the amplitudes that make non-zero contributions for pion scattering on the mass shell. Author

N70-12730# Northeastern Univ., Boston, Mass. Dept. of Physics.
WEAK AND ELECTROMAGNETIC INTERACTIONS OF THE K AND PI MESONS
R. Arnowitt, P. Nath, P. Pond, and M. H. Friedman Mar. 1969 9 p refs Sponsored in part by NSF Prepared jointly with MIT
Avail: Issuing Activity

The assumption of Pi and sigma dominance of the weak and electromagnetic decays of the K and eta mesons is examined using the hard meson current algebra amplitudes for the strong interaction factors. The kaon yield three pions, eta yields three pions decay spectra, the kaon (OO sub L yields 2 gamma decay, and the kaon (0) sub L kaon (0) sub s mass difference are calculated and found to be in good agreement with experiment. Author

N70-12744# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
ROTATIONAL COMPOUND STATE RESONANCES IN SUBTHRESHOLD ATOMDIATOM COLLISIONS
James Terry Muckerman (Ph.D. Thesis) 28 Aug. 1969 156 p refs
(Grants NSF-GP-7409; NGL-50-002-001)
(PB-185848; WIS-TCI-356) Avail: CFSTI CSCL 07D

Resonance behavior in subthreshold scattering of atoms by rigid diatomic molecules is demonstrated by exact (close-coupled) calculations involving the solution of the Schrodinger equations with closed channels included in the basis set. These resonances arise from virtual (rotational) inelastic processes resulting in the formation of temporarily excited diatom-atom bound states, and are, in principle, observable as rapid disturbances in the energy dependence of the integral elastic scattering cross section. Each isolated resonance is characterized by an energy and width by fitting the exactly calculated phase shifts to a Breit-Wigner resonance form. Author (USGRDR)

N70-12746# Brookhaven National Lab., Upton, N.Y. Div. of Technical Information.
ACCELERATING STRUCTURE FOR A HIGH-ENERGY PROTON LINEAR ACCELERATOR
V. G. Andreev Aug. 1969 26 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Radiotekhn. Inst. report
(BNL-TR-287) Avail: CFSTI

The small RF losses, the strong coupling between adjacent cells at comparatively low voltages on the coupling elements, the azimuthal symmetry of the accelerating field, and the simplicity in construction and technical preparation of a resonant cavity loaded with discs and excited in the TM sub 02n mode are studied for a high-energy proton linear accelerator. Author (NSA)

N70-12748# Princeton-Pennsylvania Accelerator, Princeton, N.J.
LEVELS IN Bi-203, Bi-205, and Bi-207
P. K. Hopke, R. A. Naumann, and E. H. Spejewski 10 Jul. 1969 42 p refs
(Contract AT(30-1)-2137)
(PPAR-15) Avail: CFSTI

The decay of the odd-mass isotopes of polonium to levels in Bi-230, Bi-205, and Bi-207 were studied. Isotopically separated sources were produced and mass idspersed by means of the Princeton electromagnetic isotope separator. Gamma ray and conversion electron spectra were observed. With the aid of gamma–gamma coincidences, level schemes were constructed for these three bismuth isotopes. Author (NSA)

N70-12750# Missouri Univ., Rolla. Space Sciences Research Center.
INVESTIGATION OF DEFECT CLUSTERS IN SILICON P-N JUNCTIONS
C. H. Irani, P. E. Johnson, J. L. Van Meter, and C. A. Goben 1968 5 p refs Conf. on Nucl. and Space Radiation Effects
(Contract AT(11-1)-1624)
(COO-1624-17; CONF-690704-7) Avail: CFSTI

A method for observing the neutron-induced defect cluster in the p–n junction depletion region is briefly discussed. The effects of an electric field on the mobility of neutron-induced defects in silicon were studied, and the results are presented. NSA

N70-12754# Gosudarstvennyi Komitet po Izpolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
PARAMETERS OF THE LINEAR ACCELERATOR I-100, DURING ACCELERATION OF BEAMS OF HIGH INTENSITY
S. A. Il'evskii, I. M. Kapchinskii, B. I. Polyakov, L. M. Popinenkova, V. A. Teplyakov et al 1968 29 p refs In RUSSIAN
(IFVE-INZH-68-63) Avail: AEC Depository Libraries; CFSTI (US

Sales Only)

The results of measuring the I-100 linac parameters, when a 100 mA current of protons was obtained, are presented. It is shown that in spite of large beam loading the width of the integral spectrum of the accelerated particles is not larger than the designed one. If the cavities are tuned more carefully it is possible to make the integral spectrum equal the momentary one. The momentary spectrum is close to the one, that was predicted theoretically for the ideal accelerating system. Author (NSA)

N70-12755# Avco-Everett Research Lab., Everett, Mass.
MARK 2 TORUS EXPERIMENT Quarterly Progress Report, 26 Mar.–29 Jun. 1969
Aug. 1969 16 p refs
(Contract AT(30-1)-3863)
(NYO-3863-14) Avail: CFSTI

Efforts to improve the injection of electrons into the Mark 2 have continued. Increasing emphasis, however, has been placed upon the containment problems and upon problems connected with ion extraction and analysis. NSA

N70-12788# Los Alamos Scientific Lab., N.Mex.
COMPUTER SIMULATION OF LEED PATTERNS FROM THE (III) PLANAR SURFACE OF URANIUM DIOXIDE. PART 1: INITIAL STUDIES
Roy C. Feber and Derrick P. Grimmer Apr. 1969 22 p refs
(Contract W-7405-eng-36)
(LA-4152) Avail: CFSTI

Computer calculations were made with three-dimensional models to simulate experimental low-energy electron-diffraction (LEED) patterns from the (111) face of stoichiometric and nonstoichiometric uranium dioxide. Laser-beam diffraction by two-dimensional (111) statistical structures is also simulated. A simple kinematical diffraction analysis is used. The computer results are of particular interest because they suggest that previously unconsidered crystallographic modifications of the planar surfaces may contribute to the observed diffraction patterns. Agreement between the calculated diffraction features and the LEED results for stoichiometric uranium dioxide requires a model in which the interlayer spacing at the surface differs from that for the bulk lattice. Results for the nonstoichiometric oxide are simulated by a model in which random triads of uranium ions move out of plane. Author (NSA)

N70-12763# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
AN ISOMERIC TRANSITION IN Ce-135
Z. Vilgelmi, Kh. Drosta, E. Levitovich, T. Morek, and S. Khoinatskii 1969 11 p refs In RUSSIAN
(JINR-P6-4499) Avail: AEC Depository Library

The conversion electron spectrum from the decay of an isomeric level of Ce-135 produced in the reaction Te-128(C-12,5n)Ce-135, was investigated. In the decay Ce-135m transitions with 82, 150, 213, and 150 keV energies were observed. For the isomeric transition with energy of 150 keV the alpha sub k/alpha sub L ratio was obtained. It suggests E3 multipolarity for this transition. Author (NSA)

N70-12783# Gulf General Atomic, San Diego, Calif.
NEUTRON AND GAMMA-RAY SPECTRA IN AN IRON SPHERICAL ASSEMBLY
R. J. Cerbone [1969] 20 p Presented at 15th Ann. Meeting of the Am. Nucl. Soc., Seattle, 15-19 Jun. 1969 Sponsored by DASA
(Conf-690609-7) Avail: CFSTI

The neutron angular flux spectra from 1 keV to 10 MeV and the gamma-ray spectra and its associated time dependence were measured, the spatial- and angular-dependent neutron spectrum in a 76.2-cm-diameter steel sphere was measured using conventional time-of-flight techniques. The gamma-ray spectrum measurements were primarily a feasibility study to show that these measurements can be made in a bulk assembly. NSA

N70-12800# Brookhaven National Lab., Upton, N.Y. Div. of Technical Information.
MODERN RF ACCELERATING STRUCTURES FOR PROTON LINEAR ACCELERATORS
V. G. Andreev 1969 11 p refs Transl into ENGLISH from Akad. Nauk SSSR. Radiotekhn. report
(BNL-TR-290) Avail: CFSTI

A brief review of the development of radio frequency accelerating structures for proton linear accelerators is presented. NSA

N70-12802# Oak Ridge National Lab., Tenn. Isotopes Information Center.
RADIO-RELEASE IN REVIEW WITH SPECIAL EMPHASIS ON Kr-85 CLATHRATES AND KRYPTONATES
Joan E. Carden 1969 54 p refs
(Contract W-7405-eng-26)
(ORNL-IIC-18) Avail: CFSTI

A review is presented that discusses the development of the radio-release method, in which a nonradioactive component is determined indirectly by the quantitative release of a radioactive material from a radioactive reagent with which the sample is contacted. Eighteen successful radio-release techniques are discussed in detail with special emphasis on the high versatile kryptonates, and sensitivity data are presented. Discussions of the nonkrypton analytical tracer techniques, such as the determination of active hydrogen with lithium aluminum tritide, and of the Kr-85 clathrates precede the discussion of the preparation, properties, and numerous applications of the kryptonates. Author (NSA)

N70-12806# Mound Lab., Miamisburg, Ohio.
SELF-ABSORPTION AND ENERGY SPECTRUM DISTORTION OF ALPHA PARTICLE EMISSION FROM MICROSPHERICAL SOURCES
C. J. Kershner 22 Aug. 1969 16 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1655) Avail: CFSTI

Relationships were derived based on fundamental geometrical factors and with a minimum of assumptions which can be used to describe or predict the energy spectrum and effective emission of alpha-particles from a microsherical source. The calculated values using the derived relationships and experimental data for Pu(238)02 microspheres are in good agreement. Author (NSA)

N70-12807# European Organization for Nuclear Research, Geneva (Switzerland).
POSSIBILITIES OF RAPID EJECTION OF 85-GeV PROTONS FROM THE IFVE ACCELERATOR [SUR LES POSSIBILITIES D'EJECTION RAPIDE DES PROTONS D'UNE ENERGIE DE 85 GeV DE L'ACCELERATEUR DE L'IFVE]
K. P. Myznikov and V. M. Tatarenko Dec. 1968 22 p refs Transl. into FRENCH from Gos. Kom. po Izpolzovaniyu Atomnoi Energii SSSR report IFVE-SKU-67-10 In FRENCH
(CERN-Trans-68-22; IFVE-SKU-67-10) Avail: AEC Depository Libraries

A scheme for a somewhat modified fast ejection system is proposed. This system assures the extraction of 85-GeV protons in channels with considerably reduced field values for the kicker magnets, while eliminating completely the necessity of local deformations of the orbits. The extraction scheme is shown and described. Author (NSA)

N70-12814# University of Southern Calif., Los Angeles. Dept. of Physics.
PRECISION ENERGY LOSS MEASUREMENTS FOR NATURAL ALPHA PARTICLES IN ARGON
Hans Bichsel, C. C. Hanke, and J. Buechner Mar. 1969 49 p refs
(Contract AT(04-3)-136)
(USC-136-148) Avail: CFSTI

Energy losses of natural alpha particles from Bi-212 and Po-212 were determined in argon gas with an accuracy of about 0.2%. The Lewis correction and the multiple scattering correction are briefly discussed. The data are compared with the Bethe theory, formulated with two different shell-correction functions. Values for I (mean ionization energy) of 182 and 167 eV are obtained by the two methods. Northcliffe's measurements at higher energies favor I = 182 eV. Author (NSA)

N70-12815# Colorado Univ., Boulder.
MEASUREMENTS ON THE DECAY OF Hg-197
A. A. Bartlett, D. Bulthaup, and K. Mohan 30 Jan. 1967 12 p refs Presented at the Ann. Meeting of the Am. Phys. Soc. Sponsored by AEC
(CONF-670109-10) Avail: CFSTI

The internal and external conversion spectra of Hg-197 were studied with a high-resolution beta spectrometer. The internal conversion sources were prepared using the COLUTRON mass separator, and with these sources it was possible to resolve conversion lines as far as the N subshells for some of the stronger transitions. The i.c.c. of the 191-keV transition was compared with that of the 279-keV transition Hg-203 by an I.E.C. method. The E.C. spectrum of conversion in tin and in cadmium was studied in order to determine the intensity of the 77-keV nuclear transitions relative to the K X-rays following conversion and K capture. Detailed results on other transitions will be presented. The measurement program is continuing. Author (NSA)

N70-12816*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
SPECTROSCOPIC REASSIGNMENT AND GROUND STATE DISSOCIATION ENERGY OF MOLECULAR IODINE
Robert J. Le Roy 13 Aug. 1969 22 p refs
(Grants NGL SO-002-001; NSF GP 7409)
(NASA-CR-107349; PB-185831; WIS-TCI-331) Avail: CFSTI CSCL 07D

Re-analyzing some early band head data for 12 (BO (+) (u) (triplet Pi)), an improved value of the ground state dissociation energy is found to be D(o) = 12429/cm, differing significantly from the previously accepted value of (1245.5/cm). This result implies that the final state of one of the UV resonance series reported earlier must have a rotationless potential maximum some 25/cm high. It is further shown that the original electronic assignment of this state as ground state X O (+) (g) (singlet Sigma) is implausible. A reassignment as O (+) (g) (triplet Pi) is proposed and the nature of the O (+) (g) (triplet Pi) potential is considered. Author (USGRDR)

N70-12817# University of Southern Calif., Los Angeles. Dept. of Physics.
QUANTUM MECHANICAL COLLISION SPECTRA IN ENERGY LOSS STRAGGLING
Hans Bischel Jan. 1969 26 p refs
(Contract AT(04-3)-136)
(USC-136-147) Avail: CFSTI

The quantum mechanical collision cross sections calculated with hydrogenic wave functions for the K and L shells are used to find the moments of the straggling functions. They are compared with the corresponding moments of the free-electron collision cross sections used in the Vavilov theory. For light elements, the straggling curves are broadened by up to 5% for this effect; for heavy elements somewhat larger effects are expected. For very low particle energies, a narrowing of the curves is predicted. Author (NSA)

N70-12821# Northeastern Univ., Boston, Mass.
HARD MESON CURRENT ALGEBRA TECHNIQUES AND APPLICATIONS
R. Arnowitt and Pran Nath [1968] 75 p refs Presented at The Theoret. Phys. Inst., Boulder, Colo., 1968 Supported in part by NSF
Avail: CFSTI

Hard pion and hard kaon techniques based on the SU(2) × SU(2) and SU(3) × SU(3) chiral current algebras are described. In addition to the chiral current commutation relations, the method assumes CVC, PCAC, dominance of intermediate states by low lying single meson states, and a definite amount of momentum dependence in particle vertices. The interrelation between the chiral current algebra and the chiral invariance approaches is discussed. The reason for the absence of a current algebra derivation of the KSFR relation is examined. Hard pion deviations to the soft pion Callan-Treiman relation are obtained and found to be large if a I +1/2, J =) K meson exists. Author

N70-12831# Idaho Nuclear Corp., Idaho Falls.
GAMMA-RAY SPECTROMETRY OF NEUTRON-DEFICIENT ISOTOPES Annual Report
J. E. Cline and R. L. Heath May 1969 84 p refs
(Contract AT(10-1)-1230)
(IN-1130) Avail: CFSTI

The primary objective of this program was to produce neutron-deficient nuclides to obtain high-resoltuion gamma-ray spectra and basic information on gamma-ray branching ratios, gamma-ray energies, and intensities for the Gamma-ray Spectrum Catalogue. The emphasis in this effort is to provide nuclear laboratories and experimenters with these data obtained with state-of-the-art gamma-ray spectrometers. To make this information most useful, standard methods for obtaining and analyzing data obtained with Ge(Li) spectrometers are being developed. Neutron-deficient nuclides were produced primarily by proton bombardment of target materials using (p,xn) reactions and by (n,p) and (n,alpha) reactions using gast neutrons. Spectra were obtained for approximately 30 nuclides. Data on these nuclides include precise energies and intensities for the primary gamma rays. Considerable effort was also made in the study of the operating characteristics of standard laboratory spectrometers. Author (NSA)

N70-12840# Brookhaven National Lab., Upton, N.Y.
CHARACTERISTICS OF THE AGS HIGH BRIGHTNESS ION SOURCE
Th. J. M. Sluyters [1969] 7 p Presented at The Intern. Conf. on Ion Sources
(BNL-13674; CONF-690625-1) Avail: CFSTI

The design and operation of the AGS duoplasmatron ion source are described. The source has a minimum lifetime of eight months. Author (NSA)

N70-12841# Connecticut Univ., Storrs. Dept. of Physics.
THEORETICAL INVESTIGATIONS OF RADIATION EFFECTS IN IONIC CRYSTALS Final Report, 15 Apr. 1963 - 14 Apr. 1969
Ralph H. Bartram 13 Jul. 1969 39 p refs
(Contracts AT(30-1)-3682; AT(30-1)-2047)
(NYO-3682-7) Avail: CFSTI

Theoretical investigations of radiation effects in ionic crystals were conducted with the objectives of accounting quantitatively for the optical and magnetic properties of radioinduced defects, and of understanding other radiation effects. Energy levels were calculated by crystal-field theory for trapped-hole centers in Al2O3. An investigation of trapped N(0) in KN3 suggests a different site from that originally reported. Related investigations were conducted including postulation of a theory for positive g shifts of F centers in divalent compounds, the calculation of wave functions for divalent anions, and a band structure calculation for Al2O3. A rather different radiation effect which was studied involved channeling of energetic, heavy ions in scintillation counters. Development of a pseudopotential method for treating ion size effects in color centers and a study of thermal ionization of F centers were initiated. Author (NSA)

N70-12844# California Univ., Livermore. Lawrence Radiation Lab.
MEASUREMENTS OF EXCITED STATE POPULATION RATIOS OF ATOMIC HYDROGEN PRODUCED BY CHARGE EXCHANGE NEUTRALIZATION OF ENERGETIC PROTON BEAMS
Robert N. Mc Farland and Archer H. Futch, Jr. 20 Jun. 1969 20 p refs
(Contract W-7405-eng-48)
(UCRL-50642) Avail: CFSTI

Excited-state population ratios for atomic hydrogen were measured for energetic hydrogen ions neutralized by charge exchange with a number of different metallic vapors and permanent gases. Electric-field ionization techniques were used to determine excitation ratios. Detection of the energetic ions and neutrals was accomplished using partially depleted surface barrier detectors. Counting, using phase detection techniques in which an add-subtrac scaler was phased to the signal, provided an improved signal-to-noise ratio. Two methods were used to provide desired targets. Metallic vapor and permanent gas thin targets of the order 0.00001 microcentimeters were produced as chopped neutral beams using conventional crossed-beam techniques. Gas cells were used for extending these measurements with permanent gases to targets up to seven orders of magnitude thicker. In the latter case the ion beam was interrupted electrically. Author (NSA)

N70-12850# California Univ., Livermore, Lawrence Radiation Lab.
COMPILATION OF X-RAY CROSS SECTIONS
W. H. Mc Master, N. Kerr Del Grande, J. H. Mallett, and J. H. Hubbell May 1969 352 p refs Sponsored by AEC
(UCRL-50174-Sect-2-Rev-1) Avail: CFSTI

Graphs and tables of X-ray cross sections in the range of 1 keV to 1 MeV are included. The total cross sections presented are the sum of computed scattering cross sections and a combination of the fit to derived experimental and theoretical photoelectric cross sections. Author (NSA)

N70-12870# California Univ., Berkeley. Lawrence Radiation Lab.
COLLECTIVE FIELD ACCELERATION
Andrew M. Sessler 4 Jul. 1969 15 p refs Presented at The 7th Intern. Conf. on High Energy Accelerators, Moscow, USSR
(Contract W-7405-eng-48)
(UCRL-19242; CONF-690811-4) Avail: CFSTI

Diverse methods proposed for the acceleration of particles by means of collective fields are reviewed. A survey is made of the various currently active experimental programs devoted to investigating collective acceleration, and the present status of the research is briefly noted. Author (NSA)

N70-12871# Institute of Nuclear Research, Warsaw (Poland).
INTERDIFFUSION IN THE U-PARI/AL, MG, SI/SYSTEM
S. Gabrycki and H. Matyja 1968 11 p refs In POLISH; ENGLISH summary
(INR-1037) Avail: AEC Depository Libraries

Diffusion layer-growth in the interdiffusion in U-PAR1/Al, Mg, Si/system has been investigated in the temperature range 533 to 863 K. The activation energy and the coefficient k sub 0 were determined. Author (NSA)

N70-12877# Princeton-Pennsylvania Accelerator, Princeton, N.J.
POSSIBLE ADDITIONAL TESTS OF CHARGE CONJUGATION INVARIANCE IN OTHER THAN WEAK INTERACTIONS
Saul Barshay 13 Aug. 1969 15 p refs
(Contract AT(30-1)-2137)
(PPAR-22) Avail: CFSTI

The possible near degeneracy in mass of recently detected massive neutral boson states with opposite charge conjugation allows for the possibility that a relatively weak C-violating interaction is enhanced in mixing these states. Some observable C-violating effects that are a consequence of this mixing are discussed. Author (NSA)

N70-12882# Western Washington State Coll., Bellingham.
FISSION STUDIES ON ELEMENTS BELOW POLONIUM
Progress Report, 1 Aug. – 1 Jul. 1969
Edward F. Nauzil 1 Jul. 1969 11 p
(Contract AT(45-1)-1759)
(RLO-1759-20) Avail: CFSTI

Studies on the alpha fission of Pb-203 and Pb-208 at 25 to 65 MeV are described. NSA

N70-12895# Northeastern Univ., Boston, Mass. Dept. of Physics.
NEUTRON-PROTON BREMSSTRAHLUNG CALCULATIONS
J. H. Mc Guire [1969] 26 p refs Sponsored in part by NSF
Avail: Issuing Activity

The neutron-proton bremsstrahlung cross section between 14 and 200 MeV is calculated by including the external radiation terms to to all orders in the momentum of the photon, and by using the low energy theorem to compute the internal scattering contribution. These calculations, which employ a simple off-shell extrapolation of the elastic phase shifts, are in good agreement with the data at 200 MeV. These off-shell calculations are also compared to calculations using the corresponding on-shell phase shifts in order to determine the strength of the off-shell terms. Author

N70-12912# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
ION PROBES [DIE IONENSONDE]
F. P. Viehboeck 1969 23 p refs In GERMAN; ENGLISH summary Presented at 15th Met. Colloq., St. Christoph, Austria, 14-17 Apr. 1969 Submitted for publication
(SGAE-PH-88/1969) Avail: CFSTI

The basic principle of the ion probes is the sputtering effect of target atoms under impact of an ion beam. A review of the different types of ion probes and their applications is given. Author

N70-12917# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.
RESULTS ON RECENT WORK IN MASS SPECTROSCOPIC AND NUCLEAR PHYSICS RESEARCH AT THE REACTOR CENTRE, SEIBERSDORF
M. J. Higatsberger 1969 20 p refs Submitted for publication
(SGAE-G-14/1969) Avail: CFSTI

Mass spectroscopic studies are applied in the field of nuclear physics, neutron physics, and reactor fuel analysis, as well as in chemical, biological, and agricultural disciplines at the National Reactor and Research Center Seibersdorf. The main activity of the Center is described under the following headings: (1) neutron decay experiment; (2) cross section work of pile neutron induced reactions; (3) fission product diffusion and migration studies in high temperature reactor fuel; and (4) production of unconventional mass spectrometers for special use. Author

N70-12918# Princeton Univ., N.J. Elementary Particles Lab.
N + P YIELDS D + P(O): A TEST OF CHARGE INDEPENDENCE FROM THRESHOLD THROUGH RESONANCE PEAK
Ira Saul Hammerman (Ph.D. Thesis) 30 Jun. 1969 163 p refs
(Contracts AT(30-1)-2137 ; N00014-67-A-0151-001)
(PURC-2137-9; TR-4) Avail: CFSTI

The differential cross sections for the reaction n + p yields d + neutral pion are found in ten energy bins from threshold to 680 MeV with an accuracy greater than that of previous experiments. Also the angular distributions and the shape of the total cross section from threshold up and over the peak to 720 MeV are studied. Spark chambers, scintillation counters and a spectrometer magnet were used for the study. NSA

N70-12919# Commissariat a l Energie Atomique, Saclay (France). Departement d Electronique Generale.
USE OF CALCULATORS IN NUCLEAR PHYSICS [UTILISATION DES CALCULATEURS EN PHYSIQUE NUCLEAIRE]
J. F. Mougel 29 Jun. 1968 39 p In FRENCH; ENGLISH summary Presented at Intern. Conf. on Electron. and Automation, Herceg Novi, Yugoslavia, 24-29 Jun. 1968
(CEA-CONF-1242; CONF-680642-3; DEG/SIN-68-1470) Avail: AEC Depository Libraries

The selection of a type of calculator for a family of experiments can lead to an acquisition and processing of data very competitive with traditional methods of acquisition and processing. The cabled program systems and the registered program system are compared. The methods of connecting the calculator with the experimental apparatus can be divided into those connections established under the control of the program for the transfer of orders or of data between the control unit or the memory and the peripheral equipment; those connections established under the control of the peripheral equipment between it and the memory; and interruptions. The structures, functions, and response times of these three methods are described. The programming is then considered. The experimental characteristics for a calculator integrated in a measurement chain are outlined. Some calculators used in nuclear physics and practical examples of their use are summarized. NSA

N70-12920# Wisconsin Univ., Madison. Dept. of Physics.
CA SO4 AS A TL NEUTRON DOSIMETER
Ervin Podgorsak, James M. Hevezi, and John R. Cameron 1 Aug. 1969 10 p refs
(Contract AT(11-1)-1105)
(COO-1105-150) Avail: CFSTI

The response of thermoluminescent calcium sulfate doped with manganese and sodium and also with manganese, sodium, and depleted uranium for dosimetry of fast neutrons, thermal neutrons, and gamma radiation is reported. NSA

N70-12927*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LYMAN-GAMMA FLUORESCENCE FROM THE PHOTODISSOCIATION OF H SUB 2
J. E. Mentall and E. P. Gentieu Nov. 1969 26 p refs Submitted for publication
(NASA-TM-X-63751; X-616-69-497) Avail: CFSTI CSCL 20H

Photodissociation and fluorescence cross sections for H2 have been measured from 860 to 700 A by observing the Lyman-alpha photons emitted at 90 deg to an incident photon beam. The photodissociation quantum efficiency was found to be unity from 850 A to the photoionization threshold at 804 A and about 10% at shorter wavelength. By observing the fluorescence radiation as a function of decreasing pressure, it was determined that most of the excited H atoms where formed in the metastable 2s state and that the Lyman-alpha emission results primarily from collisional quenching. The ratio of the collisional cross section with and without Lyman-alpha emission was measured for different relative velocities and was found to increase appreciably with increasing velocity. Author

N70-12937# Battelle-Northwest, Richland, Wash. Reactor Physics Dept.
ANALYSIS OF YANKEE-ROWE BURN-UP DATA
R. P. Matsen Jul. 1969 38 p refs
(Contract AT(45-1)-1830)
(BNWL-1122) Avail: CFSTI

Burnup data from the Yankee Core Evaluation Program have been converted to isotopic concentrations in nuclei per barn-centimeter, analyzed for cross section information by least squares fitting techniques, and compared with the predictions of the RIBOT and ZODIAC G burnup codes. The Pu – U burnup equations used for the least squares analysis of the data are developed and discussed. Data from additional Yankee samples measured primarily for information about the rarer heavy metal isotopes are also presented. Author (NSA)

N70-12942# Northeastern Univ., Boston, Mass.
AN EXTENSION OF THE LOW ENERGY THEOREM TO ALL ORDERS IN THE PHOTON MOMENTUM
J. H. Mc Guire and B. J. Malenka [1969] 20 p refs Sponsored in part by NSF
Avail: Issuing Activity

The bremsstrahlung scattering amplitude is considered to lowest order in alpha for two spinless particles. It is shown that the purely off-mass-shell derivatives from the pole terms cancel exactly with corresponding terms from the internal scattering amplitude to all orders in the photon momentum, K, to order K(0). This is a statement of the familiar low energy theorem. Constraints for the on-shell as well as the mixed derivatives are also derived. By using the constraints, the bremsstrahlung amplitude may be expressed in terms of internal scattering contributions and on-shell derivatives of the pole terms. Author

N70-12958# Oak Ridge National Lab., Tenn.
AN EFFECTIVE NUCLEON-NUCLEON INTERACTION FOR USE IN NUCLEAR HARTREE-FOCK CALCULATIONS
C. W. Nestor, Jr. (Ph.D. Thesis) Jul. 1969 152 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2556) Avail: CFSTI

Certain properties of a particular type of nonlocal potential, one which includes a quadratic velocity dependent repulsion, were explored. The primary emphasis was on the determination of the parameters defining the effective interaction so that the values of the energy and density of infinite nuclear matter, as calculated in the Hartree-Fock approximation, would match the experimental values of these quantities. The reason for this emphasis, rather than the more conventional one of fitting two-body scattering data, is the observation that two potentials of very different form and predicted two-body phase shifts gave almost identical shell-model wave functions and energy levels in selected finite nuclei when the parameters were adjusted to match the energy and density of nuclear matter. It is desirable to find an effective interaction which does as little violence as possible to the two-body data, and sometime was devoted to the two-body problem. However, for the potentials studied to date, the two-body phase shifts are not fitted very well, particularly at high energies. Author (NSA)

N70-12971# California Univ., Livermore. Lawrence Radiation Lab.

STATISTICAL THEORY OF DESIGN FOR PLATING THICKNESS MEASUREMENTS BY RADIATION BACKSCATTER METHODS

Jerry D. Fox and Grover M. Taylor 1 Jul. 1969 33 p refs Presented at 29th Natl. Conv., Am. Soc. for Nondestructive Testing, Philadelphia, 13-16 Oct. 1969 Sponsored by AEC

(UCRL-71605; Conf-691005-2) Avail: CFSTI

The application of statistical experimental design techniques to methods of plating thickness measurements such as X-ray fluorescence and beta-radiation backscatter is described. Factors discussed include number of standards, accuracy of standards, thickness range, and accuracy of radiation measurements for both the standard and the unknown thicknesses. A least-means-squares technique is applied for fitting the calibration curves, and analytical techniques are used to study the effect of variations in the above factors on the final uncertainty in determination of the unknown thicknesses. Tabulated experimental and theoretical data are included for guidance in designing nondestructive testing programs that use these techniques. Author (NSA)

N70-12978# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

TREATMENT OF INFORMATION IN GAMMA SPECTROMETRY [TRAITEMENT DES INFORMATIONS EN SPECTROMETRIE GAMMA]

J. P. Boulanger 1967 51 p refs In FRENCH Presented at The Intern. Conf. on Electron. and Automation, Herceg-Novi, Yugoslavia, 24 Jun. 1968

(CEA-CONF-1243) Avail: AEC Depository Libraries

A least squares method was developed for the analysis of total absorption peaks. The decomposition of a complex spectrum by the least squares method is given and it is shown that the derivative correction improves the precision very sharply. In the calculation, spectra of any energy were generated artificially beginning with a library of simple spectra taken under the same experimental conditions. The principle of the generation is described. The use of a biparametric analysis chain made it possible to define the decay schemes by measuring the coincidence probabilities between the various transitions. Author (NSA)

N70-12984# Northeastern Univ., Boston, Mass. Dept. of Physics.

ELECTRODYNAMICS OF CHARGED VECTOR BOSONS

M. Sheinblatt (Oakland Univ.) and R. Arnowitt Aug. 1969 49 p refs Sponsored in part by NSF

(NUB-1970) Avail: Issuing Activity

The interaction of a quantized charged vector boson in the presence of an external electromagnetic field is considered. A non singular electromagnetic current operator is obtained by separating the points of the field operators by a small space-like distance epsilon super mu in a gauge invariant fashion (analogous to the construction of the current operator of spinor electrodynamics). It is shown that the matrix element of the current is gauge invariant, divergenceless in the limit epsilon super mu approaching zero, and no more than logarithmically singular, to all orders of the external electromagnetic field. The resultant theory is seen consequently to be gauge invariant and to be renormalizable. Author

N70-12997# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.

DETERMINATION OF OXYGEN BY NEUTRON ACTIVATION ANALYSIS

W. O. Tucker 4 Sep. 1969 17 p refs

(Contract W-7405-eng-26)

(Y-1686) Avail: CFSTI

Activation analysis, using 14-MeV neutrons, was used to determine oxygen in a variety of materials at concentrations from less than 100 ppM to 30 percent. The system uses a sealed-tube neutron generator with a pneumatic transfer system and dual-axis rotation during the irradiation period. The relative percent error for a single determination (95% confidence level) varies from + or − 18% at the 70-ppM level at + or − 3.4% at the 1% level and + or − 2.6% at the 30% level. Author (NSA)

N70-13020# Northeastern Univ., Boston, Mass.

INELASTIC PROTON-DEUTERON SCATTERING AT 1 GeV

A. H. Cromer Oct. 1969 7 p refs Sponsored in part by NSF

(NUB-1977) Avail: Issuing Activity

A calculation of the inelastic proton-deuteron cross section at 1 GeV is presented and compared to the upper limit measured by Bennett et al. To obtain a calculated cross section as small as the observed upper limit requires that sigma sub s, a parameter that measures the spin and isospin dependence of the nucleon -nucleon scattering amplitude, be approximately zero. Author

N70-13028# Northeastern Univ., Boston, Mass. Dept. of Physics.

ANALYSIS OF REACTION POSITRON PLUS ELECTRON YIELDS: POSITIVE PION PLUS NEGATIVE PION AND HARD-PION CURRENT ALGEBRA

M. T. Vaughn Oct. 1969 12 p Sponsored in part by NSF

(NUB-1974) Avail: Issuing Activity

The colliding beam data on e(+) + e(−) yields Pi(+) + Pi(−1) is analyzed with a pion electromagnetic form factor suggested by hard-pion current algebra. Author

N70-13040# Ohio State Univ., Columbus. Dept. of Chemistry.

PULSE RADIOLYSIS STUDIES OF FAST REACTIONS IN MOLECULAR SYSTEMS Annual Progress Report

Leon M. Dorfman 19 Aug. 1969 5 p

(Contract AT(11-1)-1763)

(COO-1763-12) Avail: CFSTI

The kinetics of the reactions of formation, decay, and charge transfer from neutral molecules were studied for molecular cations of compounds such as diphenyl, p-terphenyl, pyrene, and anthracene in 1,2-dichloroethane. The data for the rate of formation of the aromatic cation by charge transfer from the positive charge RCL(+) in the solvent: RCL(+) + A yields RCL + A(+) suggest that this process may be a rapid hole migration, rather than a diffusion of the molecules in RCL(+). The fast detection of hydrogen atoms by Lyman-alpha resonance absorption spectroscopy (1216 A) was successfully combined with the pulse radiolysis method and was applied to a study of the gas phase reaction H + O2 + M yields HO2 + M, where M = H2. Observations indicate that in pure hydrogen the formation of H-atoms in the ground state is complete within a few microsecs. The spectra and kinetics of the solvated electron in liquid ammonia and amine systems were also investigated. NSA

N70-13047# Argonne National Lab., Ill.

LOCATING AND IDENTIFYING THE SOURCE OF THE 24 MAY 1967 FISSION-PRODUCT RELEASE IN EBR-2

R. R. Smith, D. W. Cissel, C. B. Doe, E. R. Ebersole, and F. S. Kirn Apr. 1969 39 p refs

(Contract W-7405-eng-38)

(ANL-7543) Avail: CFSTI

The first verified release of fission products to the primary sodium coolant in EBR-II occurred on May 24, 1967. Primary annunciation was given by the fission gas monitor, which indicated an approximately 3000-fold increase in the concentration of short-lived Kr and Xe fission-product species in the Ar cover-gas system. Confirmatory evidence of the release was provided by analyses conducted for Xe-133 and Xe-135 in the cover gas, and for I-131 and Cs-137 in the primary coolant. By removing groups of suspect subassemblies, followed by operation of the reactor, the origin of the fission-product release was eventually attributed to an experimental UO2 − PuO2 fuel element (HOV-4) in irradiation subassembly XO11. NSA

N70-13050# Syracuse Univ., N.Y. Dept. of Physics.
ALGEBRAIC MODELS FOR WEAK INTERACTIONS
E. C. G. Sudarshan Jul. 1969 11 p refs Presented at Intern. Conf. on Symmetries and Quark Models, Detroit, 18-20 Jun. 1969 Sponsored in part by AEC
(NYO-3399-202; SU-1206-202; CONF-690607-3) Avail: CFSTI

Three distinct but correlated algebraic models for hadron semi-leptonic weak interactions are discussed. These concern nuclear beta decay and semileptonic meson and baryon decay. Relations are established with strong and electromagnetic interactions, and some predictions are obtained which agree with many experimental results. Author (NSA)

N70-13051# Oak Ridge National Lab., Tenn. Thermonuclear Div.
THERMONUCLEAR DIVISION CHRESTOMATHY, 1969
Oct. 1969 36 p
(Contract W-7405-eng-26)
(PB-186210; ORNL-TM-2733) Avail: CFSTI CSCL 18A

Toroidal confinement program; Mirror confinement program; High-beta plasmas; Plasma production and heating; Fusion feasibility studies; Superconductivity and magnetics research; and Atomic and molecular physics. USGRDR

N70-13052# California Univ., Los Angeles. Particle Physics Research Group.
UCLA PARTICLE PHYSICS RESEARCH GROUP Annual Progress Report, 1 Jun. 1968 - 31 May 1969
1 Jun. 1969 35 p refs
(Contract AT(11-1)-34)
(UCLA-34P106-38) Avail: CFSTI

Research from June 1, 1968 to May 31, 1969 on pion plus proton and neutron plus proton interactions is described. Also the PDP-5, PDP-8/1 data acquisition system and the calibration of a scintillation counter array for the detection of neutrons are described. Author (NSA)

N70-13058# Northeastern Univ., Boston, Mass. Dept. of Physics.
SURVEY OF CURRENT ALGEBRA ANALYSES OF PION-PION AND KAON-PION INTERACTIONS
R. Arnowitt 1969 32 p refs Presented at Conf. on the Pion-Pion and Kaon-Pion Interactions, Argonne, Ill., May 1969 Sponsored in part by NSF
Avail: Issuing Activity

A brief survey is presented of attempts to describe the pion--pion and kaon--pion interactions, which are particularly amenable to current algebra analyses. The soft and hard pion analyses of pion--pion threshold parameters are described, and the theoretical results for the hard pion case are compared with experiment. Calculations of the decay distributions of eta-meson yields 3 pions and kaon yields 3 pions are summarized. Current algebra analyses are also applied to higher energy pion--pion scattering K sub l3 decays, and kaon--pion scattering. Extensions are made to applications of the Veneziano amplitude to pion and kaon systems. N.E.N.

N70-13089# Northeastern Univ., Boston, Mass. Dept. of Physics.
APPLICATIONS OF CHIRAL CURRENT ALGEBRA
R. Arnowitt 1969 24 p refs Presented at Intern Conf. on Symmetries and Quark Models, Detroit, Jun. 1969 Sponsored in part by NSF
Avail: Issuing Activity

Summarized are some applications of hard meson chiral current algebra techniques to boson systems. Current algebra assumptions employed in soft pion calculations are used to obtain amplitudes with broken chiral and broken SU(3) symmetries and current algebra constraints for small shell pions, both at threshold and at higher energies. G.G.

N70-13090# Northwestern Univ., Evanston, Ill.
CHIRAL SYMMETRY AND THE PVV INTERACTION
Laurie M. Brown and Herman Munczek 1969 14 p refs Presented at Coral Gables Conf. on Fundamental Interactions, 1969 Sponsored in part by NSF
Avail: Issuing Activity

Considered are four possible additions to the usual chiral Lagrangian all of which lead to a Gell-Mann-Sharp-Wagner model of meson decays based upon direct interaction of a pseudoscalar and two vector mesons. By allowing a possible modification of either parity charge axial current or field algebra the above described type of the pseudoscalar-two meson interaction can be constructed. G.G.

N70-13096# Scientific Translation Service, Ann Arbor, Mich.
ACTIVITY OF THE FISSION PRODUCTS OF U-235 AND PU-239
R. de Tourreil [1969] 26 p refs Transl. into ENGLISH from J. Nucl. Energy, v. 22, Apr. 1968 p 231-249 Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-2034) Avail: CFSTI

The influence of the different properties of the fissile nuclide and its fission products on the fission-product activities and power output is tested. For this purpose the complete system of coupled differential equations is exactly solved taking into account the effect of the neutron capture cross sections of the fission products. A direct comparison is possible in the case of an instantaneous fission. The influence of the nuclear charge distribution and of the fission products whose half-lives only are known is discussed in detail, so that the limit of validity of the calculations can be determined with precision. The activities and the beta and gamma power outputs from the fission products are then calculated for various irradiation and cooling times in the case of U 235 and Pu 239. The influence of the neutron capture cross sections of the fission products is studied by varying the neutron flux. It is shown that up to a neutron flux of the order of 10 to the 14th power N/ sq cm/s the neutron capture cross sections of the fission products do not change their activities appreciably. Author (NSA)

N70-13097# Illinois Univ., Urbana. Dept. of Physics.
THE REACTION POSITIVE KAON PLUS PROTON YIELDS POSITIVE KAON PLUS PROTON PLUS POSITIVE PION PLUS NEGATIVE PION AT 3.2 GeV/C
L. Eisenstein (Ph.D. Thesis) Mar. 1969 159 p refs
(Contract AT(11-1)-1195)
(COO-1195-163; TR-177) Avail: CFSTI

The reaction is investigated at an incident beam momentum of 3.2 GeV/c using the Argonne 30-in. hydrogen bubble chamber. The cross section for this reaction is found to be 2.2 + or - 0.2 mb. Copious production of $K^*(890)$ and $N^*(++)(1236)$ is observed. The cross section for the double resonance channel, neutral $K^*(890)$ $N^*(++)(1236)$, is determined to be 0.97 + or - 0.1 mb. The production and decay angular distributions of this final state was compared with predictions of various dynamical models and it was found that no one model completely accounts for all the features of the data. A low mass enhancement in the neutral $K^*(890)$ positive pion system is observed. It is found that kinematic effects cannot completely account for the observed enhancement. A moment analysis of the decay angular distributions indicates that the most likely spin-parity assignment for this enhancement is 1(+). Author (NSA)

N70-13103# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ON THE CONNECTION OF THE KINEMATICAL AND ANOMALOUS CUTS WITH THE S-MATRIX ON THE MASS SHELL
V. E. Troitskii and Yu. M. Shirokov 1969 15 p refs In RUSSIAN Presented at the Third Conf. on Axiomatical Field Theory

and Theory of Elementary Particles, Kiev, USSR, Apr. 1969
(ITF-69-34) Avail: AEC Depository Libraries

The discontinuities through the kinematical and anomalous cuts of the current matrix elements (21A(x)10) and (21A(x)12) are connected with the S-matrix on the mass shell. Author (NSA)

N70-13109# Iowa State Univ. of Science and Technology, Ames.
LIFETIMES OF DEEPLY EMBEDDED POSITRONS IN METALS
Wallace William Souder (Ph.D. Thesis) May 1969 146 p refs
(Contract W-7405-eng-82)
(IS-T-311) Avail: CFSTI

Measurements of mean lifetimes of positrons deeply imbedded in metals have been made. Nuclear isotopes that emit positrons were created deep within samples by photonuclear reactions induced by the Bremsstrahlung radiation of an electron synchrotron. The positron annihilation rate was shown to depend upon surface effects by measuring the lifetimes of positrons in samples of nickel in which varying percentages of annihilations occurred near the surface. The mean lifetime of positrons deeply imbedded in a large single crystal of nickel was found to be 119 + or − 5 psec. The value 188 + or − 6 psec was measured for positrons annihilating in the conventional sandwich sample made from two nickel single crystals. Other values obtained are included for: potassium, molybdenum, zinc, silver, scandium, and sodium. There was no apparent agreement with any theory. A plot showed no obvious trend. It was concluded that positron lifetime measurements may be meaningless unless care is taken to ensure that positrons annihilate in the interior of the metal single crystals. Author (NSA)

N70-13125# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
WIGHTMAN FORMULATION FOR THE NONLOCALIZABLE FIELD THEORY, PART 1
M. Z. Iofa and V. Ya. Fainberg 1969 24 p refs In RUSSIAN; ENGLISH summary Presented at 3rd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-69-23; CONF-690417-5) Avail: AEC Depository Libraries

It is shown that in the nonlocalizable field theory with exponential growth of vacuum expectation values in momentum space the Wightman functions preserve a number of properties characteristic of local field theories. It turns out that the holomorphy domains of these functions include the real points – the lost points. Using the lost points it is possible to introduce a notion of the quasilocality, to prove the theorems of the equivalence of the weak local commutativity and CPT – invariance and the theorem on the connection of spin and statistics. The theory of asymptotic fields and particles and the proof of existence of the unitary CPT – invariant S – matrix in the nonlocalizable field theory is considered. Author (NSA)

N70-13188# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemistry.
NUCLEAR CHEMISTRY AND GEOCHEMISTRY RESEARCH Progress Report, 1968 – 1969
Truman P. Kohman 30 Jun. 1969 109 p refs
(Contract AT(30-1)-844)
(NYO-844-76) Avail: CFSTI

Research progress is reported under the following headings: Moessbauer spectroscopy of natural materials; alpha spectroscopy of natural materials; alpha spectroscopy of uranium in tektites; geochronological potential of the K40 – Ca40 system; isotopic composition of lead and thallium in meteorites; investigation of the Sm147 – Nd143 and Sm146 – Nd142 systems as dating methods; possible additional cases of extinct natural radioactivity; concentrations of gold, silver, and indium in semiconductor silicon; segregation of antimony in a nickel – chromium alloy steel during temper embrittlement; instrumentation; fast gamma – gamma coincidence spectrometry for activation analysis; gamma – gamma coincidence spectrometer for measuring low-level gamma emitters; and least-squares fitting of data with large errors. NSA

N70-13201# Argonne National Lab., Ill.
PERSPECTIVES IN THE SYNTHESIS OF NEW ISOTOPES AND ELEMENTS [PERSPEKTIVY SINTEZA NOVYKH ISOTOPOV I ELEMENTOV]
G. N. Flerov 1969 31 p refs Transl. into ENGLISH from Russian report JINR-P7-4199
(ANL-Trans-746; JINR-P7-4199) Avail: CFSTI

The perspectives in the synthesis of new isotopes and elements are discussed. The methods of new element production neutron reactions, high-energy proton reactions, heavy ion reactions, and fission from excited states are considered. The possibility of the existence of stable superheavy nuclei and methods of synthesizing various isotopes of elements with Z from 114 up to 126 are discussed. Author (NSA)

N70-13203# Wayne State Univ., Detroit, Mich. Dept. of Physics.
ELECTRON PARAMAGNETIC RESONANCE STUDIES OF RADIATION EFFECTS IN SOLIDS AND CHEMICAL COMPOUNDS Technical Progress Report, 1 Jun. 1968 – 31 May 1969
Yeong Wook Kim 9 Jun. 1969 20 p refs
(Contract AT(11-1)-1054)
(COO-1054-42) Avail: CFSTI

The delayed luminescence of single crystals subjected to extremely weak radiation treatments at controlled temperatures was investigated. Results showed that the delayed luminescence in the very early stage of radiation defect formation is quite distinct from the direct luminescence observed in the F to M conversion by F bleaching. It is postulated that delayed luminescence may have something to do with positive ion vacancies. Systematic investigations were made of direct luminescence of calcium tungstate under sustained X irradiation, thermal luminescence following the X-irradiation at 77 K, and possible photoconductivity during irradiation. Three study programs on superconducting materials are being carried out. One of them deals with microwave interactions of type 2 superconducting materials in the mixed state, the second with electron tunneling properties through superconducting junctions, and the third with dc interactions of type 2 superconducting materials. These studies are being conducted with controlled X-irradiation near cryogenic temperatures. NSA

N70-13204# Duke Univ., Durham, N.C.
[HIGH-ENERGY PHYSICS] Progress Report, 1 Jul. 1968 – 30 Jun. 1969
Earle C. Fowler 5 Aug. 1969 8 p
(Contract AT(40-1)-3065)
(ORO-3065-17) Avail: CFSTI

An administrative review of research on the K(−) + p interactions at 740 MeV/c is reported for the period from July 1, 1968, to June 30, 1969. Personnel activities and equipment are also discussed. NSA

N70-13253# Los Alamos Scientific Lab., N.Mex.
ALGORITHM FOR COMPUTATION, AND TABLE OF VALUES OF THE INTEGRAL H SUB N (P,Q) = (2 PI) TO THE −1/2 POWER TIMES THE INTEGRAL FROM 0 TO INFINITY OF DWW TO THE (N − 2) POWER EXP (−1/2(W − P) SQUARED − Q/W)
W. W. Clendenin 17 Jun. 1969 142 p refs
(Contract S-7405-eng-36)
(LA-4201) Avail: CFSTI

For n = 1, 2, 3, 4, numerical values have been obtained over the parameter range −5 ≤ or = to p ≤ or = to 20 and 0 < q < or = to Q, where Q increases from 18 for p = −5 to 180 for p = 20. The parameter mesh is sufficiently fine to provide for interpolation for all intermediate values of p and q. In addition, the algorithm can be used as a subroutine to obtain needed values within a program, with an average computing time on the CDC-6600 of 0.03 second per integral. Values for higher n can be obtained from a recursion relation. Author (NSA)

N70-13260# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

CURRENT AND POTENTIAL APPLICATIONS OF RADIOISOTOPE X-RAY AND NEUTRON TECHNIQUES OF ANALYSIS IN THE MINERAL INDUSTRY

J. S. Watt 20 Mar. 1969 20 p refs Presented at Ann. Conf. of Australian Inst. of Mining and Met., Sydney, 10-15 Aug. 1969 *Its* Paper 4

(CONF-690815-5) Avail: CFSTI

Radioisotope X-ray and neutron techniques of analysis can be used for the determination of a wide range of elements in minerals. The most important applications of these techniques to the mineral industry are for on-stream analysis of slurries and solids, and for geological assay. The radioisotope X-ray techniques are the more developed ones and two installations for on-stream analysis are in routine use in mineral processing plants in Australia. Neutron techniques are being developed, and should prove valuable for geological assay of large numbers of mineral samples, for borehole logging, and for specific on-stream analysis when the cost of the equipment is warranted. NSA

N70-13268# Forsvarets Forskningsanstalt, Stockholm (Sweden).

SURVEY OF METHODS FOR VARIANCE REDUCTION IN CALCULATION OF UNCHARGED PARTICLES TRANSPORT BY MONTE CARLO TECHNIQUE

R. Fraeki Jul. 1969 20 p refs In Swedish

(FOA-4-4393) Avail: AEC Depository Libraries

Methods for variance reduction in Monte Carlo treatments of transport of uncharged particles are reviewed. Emphasis is put on methods of shielding calculations. The multiple scaling with optimal learning method is described in some detail. Effects on flow and spectrum estimation are discussed. NSA

N70-13274# Battelle-Northwest, Richland, Wash. Chemistry and Metallurgy Div.

IRRADIATION SPECTRAL INFLUENCE ON DAMAGE CORRELATION

G. E. Russcher Aug. 1969 13 p refs

(Contract AT(45-1)-1830)

(BNWL-1128) Avail: CFSTI

An irradiation neutron spectrum plays an important role in the production of irradiation damage. This influence can be demonstrated by comparing damage calculated for the total neutron spectrum of an environment with damage calculated for only the fast neutron of the spectrum, and damage calculated for a fission spectrum (often assumed equivalent to an irradiation spectrum). Author (NSA)

N70-13282# Los Alamos Scientific Lab., N.Mex.

FISSION BARRIERS AND TRANSITION-STATE SPECTRA FOR Th-232, Th-234, U-238, U-240, Pu-242, AND Pu-244 FROM (T,PF) REACTIONS

James D. Cramer 12 Jun. 1969 109 p refs

(Contract W-7405-eng-36)

(LA-4198) Avail: CFSTI

Fission probabilities and the angular distribution of the fission fragments were measured for six even-even compound-nucleus systems using the (t,pf) reaction. Angular correlations of fission fragments obtained in these experiments provide information about the low-lying collective excitations or transition states at the fission barrier. The (t,p) reaction in particular leads to neutron-rich residual nuclei unobtainable by other methods. The absence of spin coupling for (t,p) reactions on even-even targets provides angular distributions with well-defined structure in the region of the fission barrier. Outgoing protons were detected at 140 deg relative to the incident triton beam. Excitation energies ranging from 3.0 to 9.0 MeV were obtained in these experiments. Fission fragment angular distributions were measured at 24 angles from 0 deg to 140 deg relative to the kinematic recoil angle. Author (NSA)

N70-13294# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.

INFLUENCE OF ELECTRIC FIELD ON THE MOTION OF PARTICLES IN HELICAL FIELDS [VLIYANIYE ELEKTRICHESKOGO POLYA NA DVIZHENIYE CHASTITS V VINTOVYKH POLYAKH]

A. P. Popryadukhin [1969] 31 p refs Transl. into ENGLISH from Russian reprint no. 99

(AEC-tr-7058; Rept-99) Avail: CFSTI

The influence of deviation of equipotentials from the magnetic surfaces on the motion of individual particles is investigated. It is shown that, besides the regrouping of particles in the velocity space, the electric field of flat harmonics may result in trajectory mixing, exceeding considerably the Larmor radius. Author (NSA)

N70-13297# Aakdemy Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

INTRODUCTION OF RESONANCES INTO CHIRAL U(3) × U(3) DYNAMICS

A. M. Havrilik, Yu. M. Ilyin, and V. I. Sabo 1969 10 p refs In RUSSIAN Presented at 3rd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev

(ITF-69-41; Conf-690417-11) Avail: AEC Depository Libraries

Meson and Baryon resonances are introduced into the chiral U(3) × U(3) dynamics. Calculated relations among decay probabilities are in a good agreement with experimental data. Author (NSA)

N70-13300# California Univ., Berkeley. Lawrence Radiation Lab.

STRANGE PARTICLE PRODUCTION IN POSITIVE PION-DEUTERON INTERACTIONS FROM 1.1 TO 2.4 GeV/c

Donald Wayne Davies (Ph.D. Thesis) Jul. 1969 72 p refs

(Contract W-7405-eng-48)

(UCRL-19263) Avail: CFSTI

We have studied properties of strange-particle final states arising from reactions of 1.1 −2.4 GeV/c positive pions on deuterium. Total cross sections on deuterium are presented, and three reactions are analyzed in terms of the impulse model. Y*(1385) production dominates the n Lambda hyperon positive koan positive pion final state, and the reaction is described near threshold adequately by a K* exchange model. The positive Sigma hyperon kaon positive pion final state is found to be primarily positive Sigma hyperon positive K*. Phi(1020) and Lambda(1520) are seen in the positive kaon negative kaon final state. Author (NSA)

N70-13301# Erlangen Univ. (West Germany). Physikalisches Inst.

CONTRIBUTION TO THE IDENTIFICATION AND SPECTROSCOPY OF CHARGED PARTICLES PRODUCED BY NEUTRON AND PROTON INDUCED REACTIONS

G. Philipp Mar. 1969 26 p refs In GERMAN

(BMwF-FBK-69-8) Avail: AEC Depository Libraries

A counter telescope for the identification and spectroscopy of charged particles produced in fast neutron-induced reactions is described. Background reduction is obtained by the use of coincidence-anticoincidence electronics. The different types of particles are distinguished by analog pulse multiplication. The possibility is discussed whether the conclusion that there is cluster formation on the surface of medium and heavy nuclei can be drawn from the separated energy spectra of protons, deuterons, tritons, He-3 and He-4 particles. The measurements with 14 MeV neutrons are elaborated by experiments with charged particles performed at the tandem accelerator in Erlangen. In many of these experiments the discrimination of particles can be achieved by varying the depletion depth of surface barrier detectors alone. Author (NSA)

N70-13304# California Univ., Berkeley. Lawrence Radiation Lab.

WHAT'S NEW AND OLD IN THE RANGE-ENERGY RELATION?

Harry H. Heckman May 1969 24 p refs Presented at Intern. Conf. on Hypernucl. Phys., Argonne, Ill, 5-8 May 1969
(Contract W-7405-eng-48)
(UCRL-19214; CONF-690503-4) Avail: CFSTI

A survey of the developments in the work on the range–energy relation for charged particles in nuclear emulsions is presented. NSA

N70-13305# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

SYSTEMS OF PARTICLES WITH COULOMB INTERACTION, PART 1

G. F. Filippov 1969 10 p refs In RUSSIAN
(ITF-69-32-Pt-1) Avail: AEC Depositories Libraries

A previously developed technique for dealing with one-particle oscillator functions is used for the variational calculation of the ground-state energy of a particle system with Coulomb interaction. Polyelectronic atoms and the quasi-neutral electron – proton systems are considered. Author (NSA)

N70-13306# Stanford Linear Accelerator Center, Calif.

SLAC: STATUS, RECENT PROGRESS, AND FUTURE PLANS

R. B. Neal Jul. 1969 11 p refs Presented at the 7th Intern. Conf. on High Energy Accelerators, Yerevan, Armenian SSR, 27 Aug.–2 Sep. 1969 Sponsored by AEC
(SLAC-PUB-624; CONF-690811-3) Avail: CFSTI

Operations, electron and positron beam performance, chopped beam capabilities, beam breakup, compensation for beam loading, major replacement components, and recent improvements and additions are discussed. Author (NSA)

N70-13308# California Univ., Berkeley. Lawrence Radiation Lab.

IN-BEAM PROTON GAMMA RAY COINCIDENCE STUDIES USING A LARGE COAXIAL GE(LI) DETECTOR

Joel M. Moss Apr. 1969 196 p refs
(Contract W-7405-eng-48)
(UCRL-18902) Avail: CFSTI

Two different applications were made of particle-gamma ray coincidence techniques: first, in the Fe-54(p,p')Fe-54 reaction at 10 MeV and then, in the reactions Fe-54, 56(p,p') Fe-54 reaction at 10MeV, the angular correlation of gamma rays coincident with protons detected near 180 deg was measured. Model-dependent assignments and spin limitations were made for several states. Coincident gamma rays perpendicular to the reaction plane, as a function of proton scattering angle, were observed in the reactions Fe-54, 56(p,p') Fe-54, 56 at 19.6 MeV. Analysis of these data yielded angular distributions of the spin-flip probability in the inelastic excitation of the first 2+ states in both nuclei. The spin-flip probabilities were compared to the predictions of both the collective and microscopic models of inelastic proton scattering. Author (NSA)

N70-13309# Rochester Univ., N.Y. Dept. of Physics and Astronomy.

PI-PI SCATTERING IN THE I EQUALS 2 CHANNEL

W. M. Katz, T. Ferbel, P. F. Slattery, and H. Yuta 16 Jul. 1969 11 p Presented at The Conf. on Pi-Pi and K-Pi Interactions, Argonne, Ill., 14–16 May 1969 Supported by AEC
(UR-875-282; CONF-690521-5)

Preliminary measurements of the s-wave and d-wave I = 2 pion pion scattering phase shifts are obtained. The I = 2 s-wave phase shift at the mass of the K deg is –8.7 + or – 0.9 deg. Author (NSA)

N70-13310# California Univ., Berkeley. Lawrence Radiation Lab.

PARTIAL-WAVE ANALYSIS OF K PLUS P ELASTIC SCATTERING

B. H. Hall, R. W. Bland, G. Goldhaber, and G. H. Trilling Jul. 1969 12 p Presented at The Intern. Conf. on Elementary Particles, Lund, Sweden, 25 Jun.–1 Jul. 1969 Sponsored by AEC
(Contract W-7405-eng-48)
(UCRL-19231; CONF-690608-6) Avail: CFSTI

Revised results for partial wave solutions for kaon (+) + proton elastic scattering are given for 864 and 969 MeV/c, based on final data, and several solutions at 1207 MeV/c are given which were obtained using new polarization data. It is concluded that up to 1200 MeV/c there are no large inelastic resonances in the kaon (+) proton channel. The data are consistent with a smooth slow variation of all partial wave amplitudes from threshold to 1200 MeV/c with a consistently large negative S-wave phase shift agreeing reasonably well with a previous nonresonant solution. Author (NSA)

N70-13312# Scientific Translation Service, Ann Arbor, Mich.

DANGERS OF RADIATION EXPOSURE DURING A MANNED SPACE FLIGHT: APPLICATION TO AN EARTH-LUNAR PROJECT

Michel Genet 12 Jan. 1968 23 p refs Prepared for Oak Ridge National Lab. Transl. into ENGLISH from Radioprotection (France), v. 3, no. 2, 1968 p 115–129
(ORNL-TR-2144) Avail: CFSTI

An attempt is made to evaluate the radiation doses, that astronauts will be likely to recieve in a manned space flight according to the different types of radiation encountered in space. The various risks are considered in a general manner and applied more specifically to the case of an earth-luner project. It is apparent from this analysis that the principal danger is from cosmic rays from solar eruptions. In fact, the dose equivalent derived from these solar proton fluxes might be several hundred rem even in the interior of the space capsule. Detection methods and possible means of protection against this type of radiation are discussed. Author (NSA)

N70-13319# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre D'Etudes Nucleaires.

DECAY OF PHOTONEUTRONS PRODUCED BY THE GAMMAS OF THE FISSION PRODUCTS OF U-235 IN HEAVY WATER

Heinz Winter and Helen Deledicq 1968 19 p refs Prepared for Oak Ridge National Lab. Transl. into ENGLISH from French J.
(ORNL-TR-2043; CEA-N-915) Avail: CFSTI

The decrease of photoneutron emission after U 235 fission was calculated directly from the decay of the gamma spectrum of the fission products. The calculations were performed for the case of thermal fission in an infinite heavy-water medium, and for fission in the high-flux reactor core. The total yield of photoneutrons calculated for fission in the infinite heavy-water medium was lower than the experimental value. NSA

N70-13324# New Mexico Highlands Univ., Las Vegas.

COMPUTER SIMULATION OF HOT-ZONE REACTIONS PART 2

Vincent C. Anselmo and Linda Rekart [1969] 4 p
(Contract AT(11-1)-1618)
(COO-1618-12) Avail: CFSTI

HP and HPH, for recoil P-32 produced in NH4H2PO2, were considered the recoiling species. The following ratio of atoms and species was used: HP: HPH:N:H:O::59:59: 118:528:236, and then these were distributed randomly in a 10 x 10 x 10 matrix. The atoms and species were moved randomly within the matrix in a stepwise manner. After each step the computer was asked to print out the new matrix. The procedure was repeated 10 times. Results from computer simulation were compared with experimental results. NSA

N70-13326# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
ELASTIC AND NONELASTIC PROCESSES AT HIGH ENERGIES WITH SCATTERING, AT OREAR'S ANGLES, OF THE PARTICLE PRODUCED [UPRUGIE I NEUPRUGIE PROTSESSY PRI BOLSHIKH ENERGIYAKH S RAZLETOM OBRAZOVAVSHIKHSYA CHASTITS NA ORIROVSKIE UGLY]
V. V. Anisovich and O. A. Khrustalev 1968 38 p refs In RUSSIAN
(IFVE-STF-68-68) Avail: CFSTI

It is supposed that at high energies: (1) the processes take place either peripherally or multiperipherally then at small momentum transfer the amplitudes fall exponentially. Thus the unitary conditions in the S-channel give the following properties to the amplitudes with the Orear's transfer (a) the amplitude of the process A + B yields A + B falls, (b) the amplitude of charge exchange and backward scattering falls with the same A + B yields C + A (c) in the same way the amplitude of the process falls with changing nonzero quantum number in the t-channel b-being min. (2) such multiperipheral processes with the Orear's transfer as A + B yields a + b + c + . . . are comparatively large. In the Orear's transfer the particles produced in the center-of-mass system are gathered along one direction their amplitude behavior is exponential. Author (NSA)

N70-13327# Brookhaven National Lab., Upton, N.Y.
PROPERTIES OF THE SIGMA (1660) PRODUCED IN NEGATIVE KP INTERACTIONS AT 3.9, 4.6, AND 5.0 GeV/c
V. E. Barnes, S. U. Chung, R. L. Eisner, E. Flaminio, J. B. Kinson et al [1969] 23 p refs Presented at Conf. on Elementary Particles, Boulder, Colo., 18-23 Aug. 1969 Sponsored by AEC and NSF Prepared jointly with Syracuse Univ.
(BNL-13823; CONF-690813-3) Avail: CFSTI

No evidence is found for the existence of a resonance near the Sigma(1660) region, decaying primarily into Lambda hyperon positive pion as reported previously. In particular, the Sigma(1660) mass, width, and branching ratios are found to be consistent with the hypothesis of a single resonance being produced. However, the observed width of this resonance is approximately twice as large as that measured in formation experiments and in lower energy production experiments. Decay rates are discussed. Author (NSA)

N70-13329# Princeton-Pennsylvania Accelerator, Princeton, N.J.
EVIDENCE FOR A LAMBDA HYPERON-POSITIVE PION RESONANCE AT 1480 MeV
Yu-Li Pan and Fred L. Forman 17 Jul. 1969 10 p refs
(Contract AT(30-1)-2171)
(PPAR-16) Avail: CFSTI

An enhancement in the Lambda hyperon positive pion mass spectrum was observed at 1480 MeV. In addition, the Lambda hyperon polarization undergoes a sharp oscillation in the same Lambda hyperon pion mass region. The best fit values for this resonance are M = 1480 + or - 15 MeV and Gamma = 35 + or - 20 MeV. Author (NSA)

N70-13330# Princeton-Pennsylvania Accelerator, Princeton, N.J.
OBSERVATION OF THE Y(1475) IN THE POSITIVE (SIGMA HYPERON PION) SYSTEM; COMMENTS ON SPIN AND SU(3) MULTIPLET ASSIGNMENT
Fred L. Forman and Yu-Li Pan 17 Jul. 1969 9 p refs
(Contract AT(30-1)-2137)
(PPAR-17) Avail: CFSTI

The observation of a resonance in the lambda hyperon positive pion system at 1480 MeV was recently reported. The positive (sigma hyperon pion) decay of this same resonance was observed at a mass of 1465 + or - 20 MeV and a width of 25 + or - 20 MeV. The weighted averages are then M = 1475 + or - 15 MeV and gamma = 30 + or - 15 MeV. The Sigma hyperon pion/Lambda hyperon pion branching ratio for the Y*(1385) and the Y*(1475) were determined to be 0.15 + or - 0.05 and 0.68 + or - 0.40 respectively. A comment is made on the spin of the Y*(1475) and its possible SU(3) multiplet assignment. Author (NSA)

N70-13336# Purdue Univ., Lafayette, Ind.
PRODUCTION OF LAMBDA HYPERON (1645) RESONANCE IN THE FINAL STATE LAMBDA HYPERON PLUS POSITIVE PION PLUS NEGATIVE PION PLUS NEGATIVE PION IN NEGATIVE KAON PLUS DEUTERON INTERACTIONS AT 4.5 GeV/c
A. C. Ammann, A. F. Garfinkel, D. D. Carmony, L. J. Gutay, D. H. Miller et al 1969 10 p Presented at High Energy Phys. Conf., Boulder, Colo., 18-23 Aug. 1969
(COO-1428-141; CONF-690813-1) Avail: CFSTI

From High Energy Physics Conference, Boulder, Colo. Evidence is presented for the production of a new lambda - pion resonance at a mass of 1645 MeV and a width of 50 MeV. S meson (0) - pion(+ or -) and kaon(-) - proton decays of the state were searched for but not observed. Author (NSA)

N70-13339# Institute of Nuclear Research, Warsaw (Poland).
NEUTRON MACRODISTRIBUTION AND BUCKLING DETERMINATION IN WWR-SM CORES. PART 1: NORMAL LATTICES
L. Adamski, K. Jozefowicz, and E. T. Jozefowicz 1968 51 p refs
(INR-968-IXR-PR) Avail: CFSTI

Thermal, epithermal, and fast neutron distributions in various configurations of the normal lattice WWR-SM core have been measured. Axial and radial buckling components and extrapolation lengths have been derived. Experimental results are compared with the Polish and German theoretical calculation. Author (NSA)

N70-13351# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
PROPERTIES OF A PROGRAM SYSTEM FOR COMPUTER CONTROLLED NUCLEAR PHYSICS EXPERIMENTS DERIVED FROM ANALYSIS OF A SIMPLE EXPERIMENT [EIGENSCHAFTEN EINES PROGRAMMSYSTEMS FUER RECHNERGEFUEHRTE KERNPHYSIKALISCHE EXPERIMENTE HERGELEITET AUS DER ANALYSE EINES EINFACHEN EXPERIMENTES]
L. Frevert Jun. 1969 128 p In GERMAN; ENGLISH summary
(BMWF-FBK-69-22) Avail: AEC Depository Libraries

A simple nuclear physics experiment which is to be performed with the assistance of a digital computer handling the data on-line, controlling the measurements, and automatizing part of the experiment, is analyzed. The structure of the experiment program and some features of a system program are described, which connects the parts of the experiment program and permits multiprogramming. Author (NSA)

N70-13358*# Arizona Univ., Tucson. Dept. of Physics.
PROPERTIES OF AXICON SYSTEMS FOR COLLECTING FOIL-EXCITED ACCELERATOR BEAM SPECTRA
John O. Stoner, Jr. [1969] 25 p refs
(Grant NGR-03-002-017)
(NASA-CR-107213) Avail: CFSTI CSCL 20H

The properties of a particular king of light-collecting system used for spectroscopy of light emitted by foil-excited accelerator beams are described. This system, built to test the possibility of obtaining narrow lines from such sources, has as its basic optical

element an axicon, a conical reflector with its axis coincident with that of the accelerator beam. The properties of an axicon followed by a lens and aperture are considered and some criteria which are appropriate to the design of optical systems using these devices are set forth. Scattering of the accelerator beam by the foil which contributes significantly to spectral linewidths is demonstrated experimentally. Author

N70-13380# Georgia Inst. of Tech., Atlanta.
SPARK COUNTER NEUTRON DETECTOR FOR HIGH-TEMPERATURE APPLICATIONS Final Report
Geoffrey G. Eichholz Jun. 1969 71 p refs
(Contract AT(40-1)-3563)
(TID-25164) Avail: CFSTI

Spark counters of the corrugated electrode type were designed and tested for use as neutron detectors in high neutron fluxes and at high temperatures. These detectors consist of a gas-filled coaxial assembly, in which circular ridges, acting as spark gap electrodes with the cylindrical outer container, are interleaved with boron-containing disks, which act as neutron converters by producing alpha particles by the B-10(n,alpha)Li-7 reaction. These alpha particles trigger a spark across the gap, producing a large current pulse that is readily detected and counted. With argon or helium gas fillings, such counters were operated at temperatures up to 1076 F at which point the leakage currents across the ceramic insulator seals became excessive. The counters were tested in a wide range of neutron fluxes. The counters were found to have a linear response in neutron fluxes in the presence of gamma ray fields. The detector sensitivity at low and medium fluxes is of the order of 10 to minus 8 counts/neutron and can be varied by increasing or decreasing the number of converter disks. Author (NSA)

N70-13383# Commissariat a l Energie Atomique, Saclay (France).
VARIATION OF THE CHARGE STATE CURVES OF HEAVY IONS AS A FUNCTION OF THE ELECTRON SHELLS [VARIATION DES COURBES D ETATS DE CHARGE DES IONS LOURDS EN FONCTION DES COUCHES ELECTRONIQUES]
A. Papineau [1969] 12 p refs In FRENCH; ENGLISH summary
Presented at The Conf. on Phys. and Production of Heavy Ions, La Plagne, France, 17-21 Mar. 1969
(CEA-CONF-1280; CONF-690314-3) Avail: AEC Depository Libraries

By use of experimental data from the literature on the charge states of ions with Z > 10, an attempt was made to establish semi-empirical charge state curves of ions as a function of the electron shells of the incident ions and of the electron shells of the material crossed. The curves obtained show the continuity of the charge states of ions in reduced coordinates V/Z to 2/3 power according to the nature of the incident particle and of the absorber. Author (NSA)

N70-13397# Brookhaven National Lab., Upton, N.Y.
PERIPHERAL PROCESSES IN PROTON-PROTON INTERACTIONS AT 29 GeV/C
W. E. Ellis, T. W. Morris, R. S. Panvini, and F. Turkot 28 Jul. 1969 18 p refs Presented at The High Energy Phys. Conf., Boulder, Colo., 18-23 Aug. 1969
(BNL-13918; CONF-690813-4) Avail: CFSTI

Bubble chamber and missing-mass-spectrometer data are combined to study details of peripheral, quasi-two-body p-p interactions: p + p yields p + M. Distributions as a function of momentum transfer t to the recoil proton and of the mass M are measured for the total interaction and for specific particle compositions of M. t-distributions are found to be exponential, with a change in slope at t approximately equal to 0.2Ge/V squared. At low t, the slope is a strong function of mass M, but is nearly constant with mass at large t. Enhancements in the mass distributions at 1.4 and 1.7 GeV are analyzed. Author (NSA)

N70-13399# Uppsala Univ., (Sweden). Inst. of Physics.
TABLE OF CALCULATED GAMMA-DOSE-RATES FROM SOME COMMON ISOTOPES
C. Bergman and S. Norrby Mar. 1969 8 p refs
(UUIP-637) Avail: AEC Depository Libraries

The dose-rate from point sources was calculated for the most common isotopes which have a half-life of more than 1 hour and decay via emission of gamma quants. Author (NSA)

N70-13400# Oak Ridge National Lab., Tenn. Neutron Physics Div.
POLLA: A FORTRAN PROGRAM TO CONVERT R-MATRIX-TYPE MULTILEVEL RESONANCE PARAMETERS FOR FISSILE NUCLEI INTO EQUIVALENT KAPUR-PEIERLS-TYPE PARAMETERS
G. de Saussure and R. B. Perez 12 Jun. 1969 41 p refs
(ORNL-TM-2599) Avail: CFSTI

The program POLLA converts a set of R-matrix resonance parameters for fissile nuclei into an equivalent set of Kapur-peierls parameters. The program utilizes the multilevel formalism developed by Reich and Moore and avoids the diagonalization of the level matrix, hence, it is particularly useful where many levels and few fission channels are involved. Some applications of the program are given and a FORTRAN listing is given in an appendix. Author (NSA)

N70-13405# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
MILTIPHOTON IONIZATION OF A SODIUM ATOM [MNOGOFOTONNAYA IONIZATSIYA ATOMA NATRIYA]
G. A. Delone et al [1969] 18 p refs Transl. into ENGLISH from Russian report NP-17745
(AEC-tr-7083; NP-17745) Avail: CFSTI

The multiphoton ionization of sodium atoms in the strong optical field was investigated. The experimental results may be approximated by the power law W = AF to the k power. The k was observed to be equal to k sub 0 where k sub 0 was the number of quanta absorbed by the electron at the process of ionization in accordance with the conservation of the energy law. In earlier experiments the multiphoton ionization of noble gases was investigated in strong electromagnetic field. The measured value k appeared to be smaller than k sub 0. Apparently, the strong electromagnetic field caused the atomic energy levels to be perturbed, this effect being its result. For example in the case of 6-photon ionization of Kr atoms the perturbation could be neglected. And in accordance with the previous prediction, k proved to equal k sub 0. NSA

N70-13419# Atomic Energy Commission, Washington, D.C. Technical Information Div.
METHOD OF EXTERNAL INJECTION OF ELECTRONS INTO CLOSED TOROIDAL SYSTEMS [OB ODNOM METODE VNESHNEY INZHEKTSII ELEKTRONOV V ZAMKNUTYYE TOROIDAL NYYE SISTEMY]
E. D. Andryukhina et al Aug. 1969 7 p refs Transl. into ENGLISH from Russian report NP-17743
(AEC-tr-7082; NP-17743) Avail: CFSTI

A method is suggested for electron injection into a confined (in relation to the injector) magnetic surface using a pulsed transverse magnetic field. A magnetic trap was designed, consisting of stellarator with a double-entrance helical field. Coverage of the magnetic surface along the cross section diametrically opposite the injection point was measured with a 10 × 30 mm plane probe

that was shifted along the toroidal radius and the vertical. In case of electron injection into the helical magnetic field, the electrons covered the surface closed in relation to the magnetic surface of the injector. The graphical data are also given on the magnetic surface during electron beam injection into the stellarator field at sigma = 0.175 (the ratio of helical magnetic field harmonics to the longitudinal component). Data obtained show that the method enables investigations of the magnetic surface and the lifetime of electrons, exclusive of the influence of construction components of the electron gun. NSA

N70-13423# Iowa State Univ. of Science and Technology, Ames.
AN APPLICATION OF REGGE THEORY AND SU(3) REPRESENTATION MIXING TO HIGH ENERGY REACTIONS SUGGESTING A SECOND A SUB 2 MESON
Donald Murray Austin (Ph.D. Thesis) May 1969 90 p refs
(Contract W-7405-eng-82)
(IS-T-291) Avail: CFSTI

A mixing formalism for scalar fields carrying representations of SU(3) is developed in a field-theoretic framework and extended to boson fields with spin. This formalism is applied to the twin-peaked A sub 2 mass distribution by assuming the existence of an isovector meson multiplet belonging to the 27-dimensional representation of SU(3) which is mixed with the usual tensor octet isovector A sub 2 in a manner such that the double peak occurs for some decay modes while a single peak may occur for others. Good fits to all of the relevant data are obtained. This theory is than Reggeized and used to fit the high energy cross section data for eta production by pions. An averaged fit to the direct channel resonance structure in the total cross section data is obtained by extrapolating the Regge amplitudes to the low energy region. Also, the Regge trajectories obtained from this calculation are shown to be in agreement with those required to explain the forward peak in pion photoproduction. Author (NSA)

N70-13431*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALPHA-GAMMA ANGULAR CORRELATIONS IN THE REACTION TIN-120(ALPHA, ALPHA PRIME GAMMA SUB 1.18 MeV)
Regis F. Leonard, William M. Stewart, and Norton Baron Washington Dec. 1969 20 p refs
(NASA-TN-D-5569) Avail: CFSTI CSCL 20H

The angular correlation between inelastically scattered 42-MeV alpha particles and gamma rays emitted in the subsequent nuclear decay has been studied for the 1.18 MeV (2+) state of tin-120. The symmetry angle and the magnitude of the anisotropy of the gamma distribution have been measured for alpha-scattering angles between 15 deg and 60 deg. The results are compared with the distorted-wave predictions and with the adiabatic model. The observed symmetry angles in no way aid in removing the optical model ambiguities that exist for 42-MeV alpha particle scattering on tin. Author

N70-13434# California Univ., Berkeley. Lawrence Radiation Lab.
MODELS FOR HIGH ENERGY PROCESSES
J. D. Jackson 19 May 1969 58 p refs Presented at Intern. Conf. on Elementary Particles, Lund, Sweden, 25 Jun. - 1 Jul. 1969
(Contract W-7405-eng-48)
(UCRL-19205; CONF-690608-8) Avail: CFSTI

A review is presented of a model for high-energy processes. Topics include recent data from hadron interactions, Regge pole models, optical models and Regge cuts for multiple scattering, finite-energy sum rules and duality, Veneziano models, multiperipheralism, and production processes. NSA

N70-13500*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEMPERATURE DEPENDENCE OF SELF-DIFFUSION COEFFICIENTS FOR GASEOUS AMMONIA
Charles E. Baker Dec. 1969 15 p refs
(NASA-TN-D-5574) Avail: CFSTI CSCL 07D

Diffusion measurements were made in a stainless-steel Loschmidt-type cell; temperature ranged between 301.3 and 445.6 K, and pressures varied between 408 and 729 torr. Ammonia-N-15 was used as the tracer gas with concentrations determined by mass spectrometry. The experimental results are in excellent agreement with theoretical values calculated from rigorous kinetic theory using the Stockmayer potential parameters obtained from recent viscosity data and with values obtained directly from experimental viscosities. These results suggest that simplifying assumptions made in the calculation of collision integrals for strongly orientation-dependent potentials such as the Stockmayer potential are valid. Author

N70-13510# Scientific Translation Service, Ann Arbor, Mich.
PROGRAM FOR THE CALCULATION OF FISSION PRODUCT ACTIVITY
Roland de Tourreil [1969] 17 p Transl. into ENGLISH from the French report Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-2041; CEA-N-824) Avail: CFSTI

The PEPIN LE BREF program furnishes the exact beta and gamma activities of completely known fission products. Using analytical expressions of the solutions of differential equations, it computes the desired beta and gamma activities. The PLUS PEPIN program introduces the beta and gamma activities of fission products whose properties are partially known. It calculates these activities on the basis of a computing approximation because in principle it is only provisional and later, it should be possible to integrate it in the PEPIN LE BREF program. The description of these two programs is presented in detail so as to facilitate their management. Author (NSA)

N70-13511# Sandia Corp., Albuquerque, N. Mex. Aerospace Nuclear Safety Dept.
IMPACT TESTS OF PLASMA FIRED PU(238)O2 MICROSPHERES
W. J. Dalby Jul. 1969 219 p refs
(SC-DR-69-346) Avail: CFSTI

Rigid capsules containing production grade plasma fired Pu(238)O2 microspheres were impacted at velocities up to 456 feet per second against various targets. Particle size analyses of the impacted microspheres showed that from 0.01 to 13 weight percent was in the less than 10 micrometer range and from 0.01 to 6 weight percent was in the less than 3.5 micrometer range. Author (NSA)

N70-13513# California Univ., Livermore. Lawrence Radiation Lab.
THRESHOLD PHOTONEUTRON CROSS SECTION FOR MG-26 AND A SOURCE OF STELLAR NEUTRONS
B. L. Berman, R. L. Van Hemert, and C. D. Bowman 27 Jun. 1969 5 p refs Presented at Gordon Conf. for Photonucl. Reactions, Tilton, N.H. Sponsored by AEC
(UCRL-71829; Conf-690816-2) Avail: CFSTI

The differential cross section at 135 deg for the Mg-26 (gamma,n) reaction was measured for bremsstrahlung of 11 to 13 MeV endpoint energies using the threshold photoneutron technique. The discovery of a prominent neutron peak at 54.3 keV might have important astrophysical implications as a source of neutrons in stars via the Ne-22+ alpha yields Mg-26 yields Mg-25+ neutron reaction. NSA

N70-13519# California Univ., Berkeley. Dept. of Physics.
ATOMIC PHYSICS AND MANY-PARTICLE INTERACTIONS Final Technical Report
Kenneth M. Watson, Charles L. Schwartz, and Allan M. Kaufman 23 Oct. 1968 7 p refs
(Grant AF-AFOSR-130-66)
(AD-678181; AFOSR-68-2020) Avail: CFSTI CSCL 20/8

Studies conducted have investigated computational techniques in many-body systems of several types. These include relativistic two- and three-body equations of the Bethe – Salpeter type; atomic wave functions with correlations; helium fine structure; analyticity in scattering calculations. Several new techniques in numerical analysis, independent of any particular physical problem, have been found. Completed studies also include an analysis of the theory of cascade decays and on the scattering theory of composite particles. Publications covering these researches are referenced. Recent work includes developing techniques for studying atom – atom and ion – atom reactions using the eikonal approximation and evaluation of a recently completed theory of transport of electromagnetic radiation in a plasma. Author (TAB)

N70-13522# Columbia Univ., New York. Dept. of Chemistry.
DESCRIPTION OF THE COMPUTER CODE EVAMCO
Robert C. Reedy 28 Jul. 1969 27 p refs Presented at 158th Natl. Am. Chem. Soc., New York
(Contract AT(30-1)-1019)
(CU-1019-72; CONF-690909-1) Avail: CFSTI

The computer code EVAMCO calculates the energy and angular momentum spectra of the particles emitted from a compound nucleus using an angular-momentum-dependent statistical theory for the evaporation of particles from an excited nucleus. The program gives the channel energy and orbital angular momentum distribution of the emitted particles as well as the angular momentum distribution of the corresponding residual nucleus for the emission of various particles from a compound nucleus. The program, which considers only the first particle emitted from the original compound nucleus, can include up to six different particles competing for emission, but does not consider gamma-ray competition. The program was written in FORTRAN IV for the IBM 360 series of computers. Author (NSA)

N70-13532# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
CALCULATION OF PARTICLE DYNAMICS DURING TRANSPORT OF ACCELERATED PROTON BEAM TO INTERNAL TARGETS OF THE IFVE ACCELERATOR [RASCHET DINAMIKI CHASTITS PRI NAVED ENII USKORENNOGO PUCHKA PROTONOV NA VNOTRENNIE MISHENI USKORITELYA IFVE]
V. I. Gridasov and K. P. Myznikov 1968 29 p refs In RUSSIAN
(IFVE-SKU-68-60) Avail: CFSTI

The dynamics of accelerated protons when different methods of transporting the beam to internal targets are being applied is investigated. Taking into account the effective characteristics of the magnetic field measured at 4000 Oe and 12000 Oe, the main parameters (the shape of the closed orbit, the frequencies of the betatron oscillations) are calculated. Author (NSA)

N70-13537# Argonne National Lab., Ill.
MASS DISTRIBUTION OF THE FISSION FRAGMENTS OF THE BISMUTH AND URANIUM NUCLEI BY HEAVY IONS [MASSOVOE RASPREDELENIE OSKOLKOV DELENIYA YADER VISMUTA I URANA TYAZHELYMI IONAMI]
S. A. Karamyan et al Apr. 1969 15 p refs Transl. into ENGLISH from Russian report JINR-P7-3732
(ANL-Trans-747; JINR-P7-3732) Avail: CFSTI

Mass distributions of the fission fragments were measured in the reactions U-238(Ne-20,f), U-238(Ar-40,f), and Bi-209(Ne-20,f). The isotopes produced in these reactions were identified by the gamma-spectroscopic method using a Ge(Li) gamma spectrometer. It is shown that the mass distribution widens with the increase of the excitation energy and the Z to the 2nd power/A of the fissioning nucleus. The width parameter sigma to the 2nd power of the mass distribution increases more sharply with the increase of the excitation energy than by sigma to the 2nd power $\approx$ T. The constant C of charge distribution also increases but more weakly than sigma to the 2nd power. Author (NSA)

N70-13546# California Univ., Livermore. Lawrence Radiation Lab.
DETECTION OF A DIRECT PHOTONEUTRON REACTION IN Pb-208 NEAR 7 MeV
C. D. Bowman, R. J. Baglan, and B. L. Berman 27 Jun. 1969 8 p refs Presented at Gordon Conf. for Photonucl. Reactions, Tilton, N.H.
(UCRL-71830; CONF-690816-4) Avail: CFSTI

A threshold photoneutron experiment on Pb-208 at 7 MeV is described. The cross section vs neutron energy data obtained at an angle of 135 deg with the photon beam on separated isotopes of Pb so that all the peaks could be assigned to the proper isotopes were examined. It is shown that the value predicted for the lower limit of the direct cross section is larger than that predicted by the Lane and Lynn inverse reaction model which proposes a direct capture mechanism in which an incoming neutron in an s-wave single particle orbit falls directly into a bound p-wave orbit, bypassing the formation of the compound nucleus and emitting a single gamma ray. It is also shown that the Pb-208 giant dipole resonance decays by neutron emission to the ground state of Pb-207. NSA

N70-13547# Bundesministerium fuer Wissenschaftliche Forschung, Bad Godesberg (West Germany).
EFFICIENCY AND CROSS SECTION OF CYLINDRICAL SCINTILLATORS IN AXISYMMETRICAL GAMMA-RAY FIELDS OF VARIOUS ANGULAR DISTRIBUTIONS [EMPFINDLICHKEIT UND WIRKUNGSQUERSCHNITT ZYLINDDRISCHER SZINTILLATOREN IN AXIALSYMMETRISCHEN GAMMA-STRAHLUNGS-FELDERN VERSCHIEDENER WINKELVERTEILUNGEN]
H.-J. Keller (Johann-Wolfgang-Goethe Univ.) and A. Schaarschmidt (Johann-Wolfgang-Goethe Univ.) May 1969 202 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-69-20) Avail: AEC Depository Libraries

After a comparative review of the approaches used hitherto the program is described in detail and the results for the following angular distributions of the radiation are shown in graphs: (1) isotropic radiation; (2) extended parallel beams at angles of 0 deg, 22.5 deg, 45 deg, 67.5 deg, and 90 deg to the axis of the scintillator; (3) a field of multiply scattered gamma-rays in an extended scattering medium, the angular distribution approximated by (a) a Gaussian distribution, (b) values by Berger, and (c) Stehfest, the direction of symmetry being parallel to the axis of the scintillator. Then the method is generalized to radiation fields of arbitrary angular dependence; results for oblique incidence of axisymmetrical radiation, again approximated by a Gaussian distribution with the direction of symmetry under the above mentioned angles to the axis of the scintillator, are presented. Author (NSA)

N70-13555# California Univ., Livermore. Lawrence Radiation Lab.
NONLOCAL INTERACTION IN THE EFFECTIVE-FIELD EQUATION: ISOTOPIC SHIFT [NELOKALNOST VZAIMODEYSTVIYA V URAVNENII DLYA EFFEKTIVNOGO POLYA. IZOTOPICHESKOVE MESHCHENIYE]
E. E. Sapershtein Apr. 1969 15 p refs Transl. into ENGLISH from Russian report IAE-1426
(UCRL-Trans-10344; IAE-1426) Avail: CFSTI

An investigation is made of the behavior of the Fermi system in an external field when the interaction forces between quasi-particles are not pointlike, i.e., the nonzero harmonics of the decomposition of the interaction amplitude of quasiparticles in accordance with the Legendre polynomials are not small.
Author (NSA)

N70-13558# Kernforschungszentrum, Karlsruhe (West Germany)
INELASTIC (n,p) REACTIONS AT NEUTRON ENERGIES OF 2 TO 10 GeV. PART 1: NEUTRON BEAMS, NEUTRON SPECTRA, AND REACTIONS WITH VARIOUS CROSS SECTIONS [INELASTISCHE NP-WECHSELWIRKUNG BEI EINER NEUTRONENENERGIE VON 2 BIS 10 GEV. 1: NEUTRONENSTRAHL, NEUTRONENSPEKTRUM UND WIRKUNGSQUERSCHNITTE VERSCHIEDENER REAKTIONEN]
V. I. Moroz et al [1969] 13 p refs Transl. into GERMAN from Russian Report JINR-P1-3909 In GERMAN
(KFK-tr-287; JINR-P1-3909) Avail: CFSTI

The methods of determining the neutron spectra, which are emitted at 0 deg to the proton trajectories in the synchrophasotron, were described. The cross sections of different channels of np-interactions were determined.
Author (NSA)

N70-13569# California Univ., Berkeley. Lawrence Radiation Lab.
STOPPING-POWER DIFFERENCES BETWEEN POSITIVE AND NEGATIVE PARTICLES AT LOW VELOCITIES
Harry H. Heckman Apr. 1969 23 p refs Presented at Am. Phys. Soc. Meeting, Washington, D.C., 1969
(Contract W-7405-eng-48)
(UCRL-19211; CONF-690422-1) Avail: CFSTI

Experimental evidence which shows that the rates of energy loss for positive particles exceed those for negative particles at equal velocities when these velocities are comparable to those of the atomic electrons of the stopping medium is presented and discussed. Nuclear emulsion studies of the particle ranges of pion (+) and pion(−) and sigma hyperon(+) and sigma hyperon(−) are described.
NSA

N70-13575# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.
CALCULATION OF SIMPLE DIFFERENTIAL NEUTRON SCATTERING CROSS SECTIONS FOR WATER BY GENERALIZED FREQUENCY SPECTRUM AND COMPARISON WITH MEASURED DATA [BERECHNUNG VON EINFACH DIFFERENTIELLEN NEUTRONEN-STREUQUERSCHNITTEN FUER H2O MITTELS DES VERALLGEMEINERTEN FREQUENZSPRECKTRUMS UND VERGLEICH MIT GEMESSENEN WERTEN]
K. Reichelt and G. Maier Apr. 1969 23 p refs In GERMAN
(JUL-587-FN) Avail: CFSTI

Differential effective cross section, integral effective cross section, and median scattering cosine values for neutron scattering from water were calculated and compared with valves obtained from frequency spectrum measurements. Only slight agreement between measured and calculated neutron scattering curves was found.
Transl. by G.G.

N70-13578# California Univ., Livermore. Lawrence Radiation Lab.
MOLECULAR BAT
T. H. Batzer 5 Aug. 1969 12 p ref Presented at 16th Natl. Vacuum Symp. Seattle, 28-31 Oct. 1969 Sponsored by AEC
(UCRL-71740; Conf-691006-1) Avail: CFSTI

One method used to produce and trap a hot hydrogen plasma for controlled thermonuclear research is to inject a beam of neutral hydrogen atoms, at 1 to 20 keV, into an ionizing and confining magnetic field. The production of such beams, accompanied by a minimum of contaminating thermal gas, presents some unusual pumping problems. The hydrogen ion source typically operates at a pressure of .0001 torr, the neutralizing gas cell at about .001 torr and, after about 10 to 15 ft of differential beam tube pumping, the plasma confinement chamber holds at 10 to the −10 power torr. The diffusing thermal gas as indicated by the gage readings can readily be pumped. However, traversing a gage across the confinement chamber indicates that a significant amount of streaming thermal gas enters the chamber from the source and neutralizers. To reduce the influx of gas to an acceptable level, a Molecular Bat has been devised to impart a transverse velocity to the streaming thermal gas without appreciably affecting the high-energy neutral beam.
Author (NSA)

N70-13583# Brookhaven National Lab., Upton, N.Y.
ELECTRON ATTACHMENT OF CCl SUB 4 IN HE USING PULSED SPARK CHAMBER EFFICIENCY AS A SENSITIVE ELECTRON INDICATOR
Joachim Fischer and Shinkichi Shibata 1969 5 p refs Presented at 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, 1-6 Sep. 1969 Sponsored by AEC
(BNL-13828; CONF-690803-13) Avail: CFSTI

The total electron attachment coefficient CCl sub 4 in He, at normal pressure and 25 C, was determined as a function of electron energy, using a technique of pulsed spark chamber efficiency as a sensitive electron indicator. The attachment coefficient diminishes from 1 million attach/cm x torr at 0.04 eV to only 77 at 4 eV. A fine structure peak in attachments per sec is apparent around 0.05 eV.
Author (NSA)

N70-13602# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.
KENO: A MULTIGROUP MONTE CARLO CRITICALITY PROGRAM
G. E. Whitesides and N. F. Cross 10 Sep. 1969 123 p refs
(Contract W-7405-eng-26)
(CTC-5) Avail: CFSTI

KENO is a multigroup Monte Carlo criticality program written in Fortran IV, level H, for the IBM 360-65 and 360-75 computers. It contains a special geometry package which allows easy description of systems composed of cylinders, spheres, and cuboids (rectangular parallelepipeds) arranged in any order with only one restriction. This restriction is that each geometrical region must be described as completely enclosing all regions interior to it. For systems not describable using this special geometry package, the program can use the generalized geometry package (GEOM) developed for the O5R Monte Carlo code. It allows any system that can be described by a collection of planes and/or quadric surfaces, arbitrarily oriented and intersecting in arbitrary fashion. Rectangular arrays of fissile units are allowed with or without external reflector regions. The scattering treatment used in KENO assumes that the differential neutron scattering cross section can be represented by P sub 1 Legendre polynomial.
Author (NSA)

N70-13606# California Univ., Berkeley. Lawrence Radiation Lab.
UNASSISTED ANALYSIS OF BUBBLE CHAMBER EVENTS
Howard S. White and Dennis E. Hall Jun. 1969 21 p refs Presented at Pattern Recognition Studies Seminar, New York
(Contract W-7405-eng-48)
(UCRL-19210; Conf-690616-2) Avail: CFSTI

Hardware and computer programs have been developed which allow bubble chamber events to be recognized and measured without manual assistance. All tracks in the three film images are digitized. Those track vertices which signify events are found, and the tracks are associated between views. Cost, precision, and reliability are favorable in comparison to manual methods.
Author (NSA)

N70-13807# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENTS OF KAONIC X-RAYS OF MEDIUM AND HEAVY ELEMENTS
Clyde E. Wiegand and Raymond Kunselman Apr. 1969 19 p refs
(Contract W-7405-eng-48)
(UCRL-18891; Conf-690503-3) Avail: CFSTI

The X-ray spectra resulting from negative kaons stopped in targets of various medium and heavy elements were measured using Ge(Li) detectors. The spectra were analyzed for indications of neutron excess in the nuclear surface. It appears that kaonic atoms are a good tool for studies on the nuclear surface. NSA

N70-13853# United Kingdom Atomic Energy Authority, Harwell (England).
THE CLOSED ORBIT OF THE SERPUKHOV 70 GeV SYNCHROTRON, AS DETERMINED BY GEODETIC SURVEYS OF THE MAGNET SECTIONS
I. V. Runov et al 1968 14 p Transl. into ENGLISH from the Russian Report
(AERE-TRANS-1113; IFVE-SKU-68-8-K) Avail: CFSTI; HMSO 2s 6d; BIS $0.60

The results of the precision survey of the spatial positions of the 70 GeV proton synchrotron magnet units made during Dec. 1966 – Oct. 1967 are given. Four surveys of the magnet units in vertical positions and two surveys in radial positions were performed. The closed orbit distortions, according to the survey data do not exceed + or – 5 mm and + or – 7 mm in the vertical and radial directions respectively. Author (NSA)

N70-13864# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
LITERATURE SURVEY CONCERNING ENERGY TRANSFER BETWEEN VIBRATIONAL MODES DURING MOLECULAR COLLISIONS IN THE GAS PHASE [ETUDE BIBLIOGRAPHIQUE DU TRANSFERT D'ENERGIE ENTRE MODES DE VIBRATION LORS DE COLLISIONS MOLECULAIRES EN PHASE GAZEUSE]
Francois Barat Oct. 1969 26 p refs In FRENCH; ENGLISH summary
(CEA-BIB-155) Avail: CFSTI

The transfer by collision of the vibrational energy of a molecule can occur by two different processes: simple transfer where vibrational energy is changed into translational energy (TV transfer) and complex transfer in which the two molecules in collision exchange their vibrational energy (VV transfer). A survey is made of this complex transfer during intermolecular or intramolecular collisions using experimental results obtained by absorption or emission spectroscopy, by the shock wave method or by ultrasonic dispersion (this latter method being described in more detail). The probabilities of vibrational energy transfer, as determined by experiment, are compared to the theoretical transfer probabilities for exchanges which are close to resonance or which are non resonant. Author (ESRO)

N70-13885# Brookhaven National Lab., Upton, N.Y.
SIMULTANEOUS INTERNAL AND EXTERNAL TARGETING AT THE AGS
L. N. Blumberg, M. Q. Barton, J. D. Fox, J. W Glenn, R. J. Nawrocky et al [1969] 11 p refs Presented at 7th Intern. Conf. on High Energy Accelerators, Moscow
(BNL-13945; CONF-690811-8) Avail: CFSTI

The vertical emittance of the external beam increases approximately quadratically as a function of beam fraction internally targeted to approximately 1.8 of the non-simultaneous emittance for 50% interacting internally. The external beam extraction efficiency is approximately constant in the interval 0 to 80% internally targeted. However, internal targeting efficiency decreased by about 20% in the simultaneous mode due to decreased machine aperture within the 3 lambda/2 slow external beam orbit deformation. This loss was reduced by installation of a lambda/2 orbit deformation. It was concluded that the simultaneous targeting method is more effective than nonsimultaneous targeting in utilization of the AGS beam for the case where internal targeting is limited to < or = to 1.5 x 10 to the 12th power protons/pulse and the AGS beam exceeds approximately 2 x 10 to the 12th power protons/pulse. Author (NSA)

N70-13886# Colorado Univ., Boulder.
ON-LINE PROMPT AND DELAYED ELECTRON AND GAMMA RAY SPECTROSCOPY AT THE UNIVERSITY OF COLORADO CYCLOTRON LABORATORY
J. Konijn, B. Klank, J. H. Jett, and R. A. Ristinen Aug. 1969 22 p refs Presented at Intern. Conf. on Radioact. in Nucl. Spectry., Nashville
(Contract AT(11-1)-535)
(COO-535-598; CONF-690818-2) Avail: CFSTI

The experimental facility at the University of Colorado 132-cm FFAG cyclotron for on-line measurements of gamma-ray and conversion electron spectra is described. Lithium-drifted germanium detectors, a two-meter curved crystal diffraction spectrometer, and a broad-range electron transport solenoid lithium-drifted silicon spectrometer are used. Experimental data are presented for proton reactions in tantalum foils and for proton reactions on Tb-159 and Tm-169. NSA

N70-13703 Rome Univ. (Italy). Inst. of Physics.
ELECTROMAGNETIC MASS DIFFERENCES OF HADRONS
F. Buccella, M. Cini, M. De Maria, and B. Tirozzi 10 Jul. 1969 41 p refs *Its* Nota Interna No. 231
Interna No. 231
Avail: CFSTI

Starting from the Cottingham formula, the problem of the mass differences of the pseudoscalar and vector mesons, baryon octet and decuplet are examined in the framework of the Harari's approach. The Born and the transition terms of all these particles are calculated using a low frequency limit which comes essentially from the strong suppression of high q squared values in the Cottingham integral due to the form factors; in this limit a universal relation between both the electric and the magnetic contributions of the Born terms to the two gauge-invariant parts of the forward nonspin flip amplitude for the Compton scattering. The residue function of the A sub 2 Regge pole is calculated via FESR, for the Compton scattering of K me sons. The application of FESR to (p–n) mass difference is critically examined. The connection with the residua of all the other particles is obtained with the use of the universality hypothesis for the coupling of A sub 2 Regge pole with mesons and baryons proposed by Cabibbo, Horowitz and Neueman. It is found that the inelastic terms thus evaluated give always a contribution of the right sign to the em mass differences. The final numerical results are in very satisfactory agreement with experiment. Author (ESRO)

N70-13713# Rome Univ. (Italy).
NECESSARY CONDITIONS FOR SATURATION OF NUCLEAR FORCES
F. Calogero and Yu. A. Simonov (Inst. of Theoret. and Exptl. Phys., Moscow) 16 Jun. 1969 32 p refs Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna No. 225
Avail: CFSTI

Rigorous conditions are given which must be satisfied by the nuclear interaction in order to be consistent with saturation. They apply to general potential shapes which are possibly not the same in different spin-isospin states. The treatment includes direct, exchange, tensor and spin-orbit interactions described by two-body local velocity-independent potentials. Author (ESRO)

N70-13716# United Kingdom Atomic Energy Authority, Harwell (England).
INCREASING THE DISCHARGE TIME IN A SPARK CHAMBER TO 10 TO 100 MSEC
Yu. K. Akimov et al Feb. 1967 58 p refs Transl. into ENGLISH from the Russian Report
(NP-TR-1810; JINR-R13-3064) Avail: AEC Depository Libraries

A method to increase the discharge duration in a spark chamber for the time up to 10–100 msec is described and investigation results of such discharge conduct in time are given.
Author (NSA)

N70-13717# Atomic Energy Commission, New York. Health and Safety Lab.
EXPERIMENTAL AND THEORETICAL STUDIES OF THE TRANSPORT OF GAMMA-RAYS THROUGH SLAB SHIELDS
Burton G. Bennett, Gail De P. Burke, and Harold L. Beck Jan. 1969 56 p refs
(HASL-205) Avail: CFSTI

The penetration of gamma rays through slab shields has been investigated in considerable detail by theoretical calculations using Monte Carlo and polynomial expansion methods and by experimental measurements using a collimated NaI(Tl) spectrometer system. Special attention was given to a 2 mfp Al slab with a 0.662 MeV gun source normally incident for which Monte Carlo calculations were made of the angular spectra of gamma rays emerging from the total slab area and those from a small central region on the exit side of the slab. The latter calculation corresponded closely to the experimental situation in which the angular spectra were measured at 11 angles from the normal to the 2 mfp Al slab. The close correlation between calculation and experiment was useful in substantiating the validity of the theoretical and experimental techniques.
Author (NSA)

N70-13721# Rome Univ. (Italy). Inst. of Physics.
A FEEDBACK REGULATED ELECTRON SOURCE
S. Cantarano and A. Egidi 10 Jul. 1969 10 p Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna No. 230
Avail: CFSTI

A simple electron source has been developed with the purpose of testing and calibrating instruments used onboard satellites in experiments on interplanetary plasma. The device is described and its performances discussed.
ESRO

N70-13726# Yeshiva Univ., New York. Belfer Graduate School of Science.
RESEARCH IN NUCLEAR PHYSICS AND NUCLEOSYNTHESIS Annual Progress Report, 1 Jun. 1968–31 May 1969
A. G. W. Cameron 3 Mar. 1969 17 p refs
(Contract AT(30-1)-3962)
(NYO-3962-1) Avail: CFSTI

Nuclear quantities desirable to predict from a theoretical [illegible] include the masses, the level densities, the radiation widths, and various types of neutron cross sections. Major new effort has been underway for the last two years to improve the ability to make reasonable predictions of these quantities in the extreme neutron-rich region off the valley of beta stability. This program is briefly described and abstracts of papers published are presented.
NSA

N70-13727# Rome Univ. (Italy).
COMMENTS ON OMEGA-LIKE REGGE POLE EXCHANGE IN KN SCATTERING
M. Lusignoli, R. Odorico (Trieste Univ.), M. Restignoli, and G. Violini 11 Jul. 1969 14 p refs Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna No. 232
(Contract F61052-67-C-0084)
Avail: CFSTI

It is shown that the evidence for the presence of a large omega absorptive correction in the B(–) amplitude at small values of t is affected by large uncertainties.
Author (ESRO)

N70-13728# Institute of Nuclear Research, Warsaw (Poland).
CORRELATED EMISSION OF LIGHT NUCLEI AND NEUTRONS IN FISSION OF U-235
J. Chwaszczewska, M. Dakowski, T. Krogulski, E. Piasecki, H. Piekarz et al 1968 7 p refs
(INR-1033) Avail: CFSTI

The yields of protons and tritons in relation to the alpha-particle yield were measured in coincidence with the prompt fission neutrons from thermal neutron fission of U-235. A conclusion as to the relation between the average number of prompt neutrons and the type of charged particles involved was deduced by making assumptions as to the angular and energy distributions of the neutrons.
Author (NSA)

N70-13736# Brookhaven National Lab., Upton, N.Y.
ORIENTED TARGETS IN NEUTRON SPECTROMETRY
V. L. Sailor 1 May 1969 89 p refs Presented at JINR School on Neutron Phys., Alushta, Crimea, 19–31 May 1969
(BNL-13624) Avail: CFSTI

A brief history of the use of oriented targets in neutron physics is presented. Some of the underlying theoretical concepts are reviewed and some experimental techniques discussed. The various applications are described and some of the experimental results are reviewed. The potentialities and the state-of-the-art are also discussed. A chapter on target technology is included.
Author (NSA)

N70-13737# Mound Lab., Miamisburg, Ohio.
IDENTIFICATION OF THE 871-keV PHOTON OBSERVED FROM Pu-238 SOURCES
F. K. Tomlinson 31 Jul. 1969 18 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1534) Avail: CFSTI

The origin of the 871-keV photon which appears in many gamma-ray spectra of plutonium-238 was experimentally determined. Gamma-ray spectra were taken with a plutonium-238 source contained in various gaseous environments. The 871-keV photon was observed only when the source was in an atmosphere which contained nitrogen, indicating that the 871-keV photon originated from the decay of the first excited state of the residual nucleus in the N-14(alpha,p)O-17 reaction. Protons from this reaction were investigated and found to be present. The intensity of the 871-keV radiation was found to be 4.83 times that of the 767-keV photon in plutonium-238 when the plutonium-238 material was exposed to air.
Author (NSA)

N70-13743# Washington Univ., Seattle.
SPONTANEOUS FISSION ISOMERS WITH VERY SHORT HALF-LIVES
R. Vandenbosch and K. L. Wolf 26 May 1969 14 p refs Presented at 2nd Conf. on Phys. and Chem. of Fission, Vienna Supported in part by AEC
(SM-122/110; RLO-1388-97; CONF-690708-2) Avail: CFSTI

The results of various reactions studied which relate to the various plutonium isomers characterized are presented. The method employed is a direct electronic measurement of the time between the arrival of a burst of particles at the target and the time of fission decay of the isomeric state.
Author (NSA)

N70-13752# Notre Dame Univ., Ind.
INTERACTION OF PHOTONS AND PARTICLES WITH NUCLEI Technical Progress Report, 1 Nov. 1968–31 Oct. 1969
Charles J. Mullin 21 Jul. 1969 16 p refs
(Contract AT(11-1)-427)
(COO-427-93) Avail: CFSTI

A brief summary is presented on the theoretical work done on the interactions of photons and particles with nuclei. The work covers the period November 1, 1968 to October 31, 1969. NSA

N70-13755# Rome Univ. (Italy). Inst. of Physics.
A GROUP THEORETICAL APPROACH TO THE MULTIPERIPHERAL MODEL
S. Ferrara and G. Mattioli 27 Jul. 1969 34 p refs Prepared jointly with Ist. Nazl. Fis. Nucl *Its* Nota Interna No. 235
Avail: CFSTI

The convergence of the multiperipheral series is investigated in the case of the scattering of two spinless particles, when the square of the space-like momentum transfer is fixed as a parameter. A coupling scheme is introduced in which the scattering amplitude is described as a pseudobilinear functional on some Hilbert spaces which contain elements describing an incoming and an outgoing particle. In this formalism every multiperipheral graph is associated a pseudobilinear functional. The properties of the series are studied by means of the crossed partial wave analysis. Using Fredholm techniques and analyticity properties it is shown that the graph series sum, in correspondence to physical values of the coupling constant is described by an unbounded functional which can be expressed only by means of the unitary irreducible representations of the principal series of O(2, 1). This formalism means that the amplitude contains some Regge pole contributions. The Regge asymptotic behaviour of the solution and a new formulation of the Froissart bound are pointed out. The usefulness of the method for the ladder approximation case is discussed. Author (ESRO)

N70-13756# Rome Univ. (Italy). Inst. of Physics.
EQUIVALENCE BETWEEN VELOCITY-DEPENDENT POTENTIALS AND STATIC POTENTIALS
F. Calogero 3 Sep. 1969 16 p refs Submitted for publication Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna No. 236
Avail: CFSTI

The possibility to introduce static potentials (possibly with hard cores) that produce, in the two-body problem, the same scattering phase shifts and binding energies of velocity-dependent potentials is analyzed. This technique immediately yields a number of results for the phase shifts and bound states produced by velocity-dependent potentials (behavior of phase shifts at large and at small energy, Levinson's theorem, Bargmann's theorem, Faddeev-Newton theorem, etc.). The latter results may be useful to display neatly the connection between appropriate experimental data (say, the S-wave scattering phase shift) and the phenomenological parameters characterizing the short range behavior of the potentials. Author (ESRO)

N70-13767# Rome Univ. (Italy). Inst. of Physics.
LOWER BOUND TO THE MAGNITUDE OF THE NUCLEAR BINDING ENERGIES OF DOUBLY MAGIC NUCLEI
A. M. Badalyan (Inst. of Theoret. and Exptl. Phys., Moscow), F. Calogero, and Yu. A. Simonov (Inst. of Theoret. and Exptl. Phys., Moscow) 24 Jul. 1969 44 p refs Prepared jointly with Ist. Nazl. Fis. Nucl.Its Nota Interna No. 234
Avail: CFSTI

A simple lower bound for the magnitude of the binding energies of doubly magic nuclei is presented. It states that these quantities are minorized by the corresponding quantities evaluated for a two-body problem with an effective potential that is an appropriate integral transform of the original two-body nucleon-nucleon central potentials. Author (ESRO)

N70-13775# Princeton-Pennsylvania Accelerator, Princeton, N.J.
PRECETRON: A PRINCIPLE FOR OBTAINING PION-PION AND MUON-MUON COLLISIONS
Robert Macek and Bogdan Maglic 24 Jun. 1969 43 p refs
(Contract AT(30-1)-2171)
(PPAR-14) Avail: CFSTI

A storage device for pion + pion collisions in the mass region of the meson (rho), and for muon + muon collisions was proposed and its parameters calculated. The orbit–precession device called the precetron, has a large momentum acceptance of pions and large angular acceptance in contrast to a conventional storage ring which would require well-defined momentum and small angular divergence in order to have the pions captured. Single particle orbits and pion densities are calculated, and the collision rate is discussed. After several pion lifetimes the muons from the decaying pions orbit in similar precessing orbits to those of the pions and similar collision rates can be obtained. NSA

N70-13786# Wisconsin Univ., Madison.
POLARIZATION IN NUCLEON-DEUTERON SCATTERING
W. Haeberli 15 Aug. 1969 44 p refs Presented at Intern. Conf. on the Three-Body Probl., Birmingham, Engl.
(Contract AT(11-1)-GEN-7)
(COO-7-515; CONF-690710-1) Avail: CFSTI

A summary of the experimental information on polarization effects in nuclear-deuteron scattering is presented. The emphasis is on elastic scattering experiments but some mention is also made of polarization effects in the breakup channels. NSA

N70-13789# Gulf General Atomic, San Diego, Calif.
INTERNAL NEUTRON THERMALIZATION Quarterly Progress Report, 1 Apr.–30 Jun. 1969
E. L. Slaggie, G. M. Borgonovi, and D. H. Houston 15 Jul. 1969 33 p refs
(Contract AT(04-3)-167)
(GA-9489) Avail: CFSTI

Calculations of the coherent scattering law and the total cross section for polycrystalline beryllium are presented. Studies on phonon frequency shifts in zirconium hydride and graphite due to thermal expansion are described. Crystal binding effects on Doppler broadening of neutron absorption resonances are discussed and calculations for U-238 in UO2 are presented. NSA

N70-13815# Electronic Specialty Co., Portland, Oreg. Electronics Div.
QUANTUM THEORY: PARTIAL EXCITATION
James W. Deer 25 Sep. 1969 28 p refs
(AD-693935; Rept-2) Avail: CFSTI CSCL 20/10

Further development is given of previous theory of partial excitation (AD-683 388). It is shown that the Schrodinger wave equation results from properties of the Maxwell-Lorentz-Schrodinger field. This latter is obtained by fusion of the Schrodinger amplitude into the Maxwell-Lorentz equations. Partex (partial excitation theory) gives a different value of energy for ground state of the hydrogen atom, as compared to quantum mechanics. This is because partex does not involve use of reduced electronic mass in calculation of ground state energy. In this theory the electronic charge cloud has no particle-like aspect. Author (TAB)

N70-13843# Purdue Univ., Lafayette, Ind.
THE DELTA PHASE SHIFT AT LOW PION-PION MASSES
J. H. Schargenguivel and F. T. Meiere Jul. 1969 15 p refs Presented at High Energy Phys. Conf., Boulder, Colo. Sponsored in part by AEC
(COO-1428-142; CONF-690813-2) Avail: CFSTI

The forward-backward asymmetry for pion-pion masses square root of S < 0.6 GeV, was parametrized as a function of s and the squared four-momentum transfer. Author (NSA)

N70-13846# European Space Research Inst., Frascati (Italy).
CAN SATELLITES OCCUR AT HIGHER ENERGIES THAN THE PARENT LINE?
J.-P. Connerade Sep. 1969 9 p refs Submitted for publication *Its* Internal Note No. 50
Avail: CFSTI

Displaced spectra due to the transition of a core electron to an outer state have been reported in ultraviolet spectra and supernumaerary lines or satellites have been observed close to the normal members of the Rydberg series of vacuum sparks. The latter phenomena have been interpreted as inner shell transitions in ions of the same element but of lower charge, the energy difference being due to screening by spectator electrons. This report examines the suggestion that additional outer electrons always cause a shift to longer wavelengths. The Hartree-Fock calculations were restricted to transitions ending on the ground states and tables of data are given for the Fe X - Fe XXIV, Si VI - Si XII, Ar IX - Ar XII and P VI - P IX sequences. ESRO

N70-13853# Naval Research Lab., Washington, D.C.
ELECTRON-ELECTRON SCATTERING EFFECTS IN THE LOW-TEMPERATURE LORENZ NUMBERS OF DILUTE Pd-Ni ALLOYS
J. T. Schriempf, A. I. Schindler, and D. L. Mills (Calif. Univ., Irvine) 15 Sep. 1969 32 p refs
(AD-694453; NRL-6949) Avail: CFSTI CSCL 20/12

The thermal and electrical resistivities of Pd-Ni alloys at concentrations ranging from 0 to 1.0 at-% Ni have been measured at temperatures between 2 and 20K. The Lorenz numbers Le appropriate to electron-electron scattering have been extracted from the data and are found to be relatively insensitive to Ni concentration. A theoretical calculation of Le has been carried out under the assumption that the entire current is carried by s electrons which are scattered from spin density fluctuations of the electrons in the d band. A consistent interpretation of the data is obtained by employing the local enhancement model, while the uniform enhancement model is found to yield values of Le which decrease too rapidly with increasing Ni concentration to reasonably represent the experimental results. The calculated value of Le is significantly smaller than the experimental value for pure Pd; it is felt this may be due to the neglect of detailed band structure effects in this work. Lorenz numbers for Baber scattering have also been calculated by using Coulomb interaction screened by the d electrons. It is found that the presence of Baber scattering cannot remove the discrepancy between theory and experiment for pure Pd. The Baber scattering model is also used to calculate the Le for rhenium and gives very good agreement with experiment. Author (TAB)

N70-13878# Scientific Translation Service, Ann Arbor, Mich.
STUDY OF THE ENERGY AND ANGULAR DISTRIBUTION OF ELECTRONS BEHIND BARRIERS OF DIFFERENT THICKNESS
B. A. Kononov et al [1969] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), v. 19, 1968 p 147 - 149 Prepared for ORNL
(ORNL-tr-2178) Avail: CFSTI

Plotted data are presented to show the angular distribution of electrons after penetrating thin Be and Cu targets and the energy distribution after penetrating thick C targets. Target thicknesses and incident betatron beam energies were: Be - t = 2.26 mg/cm2, E = 2.91 MeV; Cu - t = 1.7 mg/cm2, E = w.91 and 5.89 MeV; C t q 0.53, 1.25, and 1.78 g/ = 2 to 6.6 MeV. Agreement between experiment and theory was within 5% for Cu, but for Be the measured value was twice the calculated value. For the thick C targets the theory of Moliere describes well the electron distribtion when energy losses are less than 10% of the initial energy, but the theory does not hold when energy losses exceed 10%. Author (NSA)

N70-13877# Kernforschungszentrum, Karlsruhe (West Germany).
INFLUENCE OF THE HEXADECAPOLE DEFORMATION ON THE PROPERTIES OF QUASI-PARTICLE STATES OF NUCLEI IN THE REGION OF THE RARE EARTHS [EINFLUSS DER HEXADEKAPOL-DEFORMATION AUF DIE EIGENSCHAFTEN VON QUASI-EINTEILCHEN-ZUSTAENDEN VON KERNEN IM BEREICH DER SELTENEN ERDEN]
F. A. Gareev et al [1969] 19 p refs Transl. into GERMAN from Russian report JINR-P4-4259 In GERMAN
(KFK-tr-294; JINR-P4-4259) Avail: CFSTI

It is shown that a number of characteristics, such as the local level density, the decoupling parameters, and the interval of the level quasi-intersection, are changed, depending on the hexadecapole deformation value. Author (NSA)

N70-13879# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
IRRADIATIONS AT LOW TEMPERATURES. PART 1: DEVICE DESIGNS [LES IRRADIATIONS AUX BASSES TEMPERATURES. PREMIERE PARTIE: CONCEPTION DES DISPOSITIFS]
Rolland René Conte Oct. 1969 38 p refs In FRENCH; ENGLISH summary
(CEA-R-3910) Avail: CFSTI

After an attempt to classify irradiation devices, the different refrigeration systems in use such as stored liquid or refrigerators, are discussed. Some financial aspects of these two systems are discussed. For a long run; 1000 hr per year (100 hr for He), refrigerators become less expensive than stored liquid devices. Some ideas concerning the principal criteria of device design are discussed and a few elements which facilitate the calculation of the different parts of a cryostat are given. Author (ESRO)

N70-13880# Rome Univ. (Italy). Inst. of Physics.
ON THE ORIGIN OF THE WEAK INTERACTION ANGLE, PART 2
N. Cabibbo and L. Maiani 19 Jun. 1969 48 p refs Prepared jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna No. 228
(Contract F61052-67-C-0084)
Avail: CFSTI

A theory of the origin of the weak interaction angle theta, based on a self-consistency condition linking weak, strong and electromagnetic symmetry breaking effects is presented. The value of theta is related to the observed pattern of breaking of SU(3) SU(3), and depends upon the value of a new parameter Xi, which gives the strength of the weak corrections to strong processes. A characteristic result of the theory is the prediction of a non electromagnetic I-spin breaking. This solves the eta yields 3 pion pubble and accounts for the observed deviation from the Dashen sum rule: Xi in a realistic model of weak interactions cannot be given, a phenomenological determination of Xi is proposed, based on the observed I-spin breaking mass splittings among pseudoscalar mesons. In this way the prediction: 0.25 which is in good agreement with the experimental value is obtained. Author (ESRO)

N70-13918# European Organization for Nuclear Research, Geneva (Switzerland).
CALCULATION OF PARTICLE DYNAMICS AT THE TIME OF IMPINGING A BEAM OF PROTONS ON INTERNAL TARGETS OF THE SERPUKHOV ACCELERATOR [CACUL DE LA DYNAMIQUE DES PARTICULES LORS DE L'ENVOI DU FAISCEAU DE PROTONS SUR LES CIBLES INTERNES DE L'ACCELERATEUR DE SERPUKHOV]
V. I. Gridasov et al Mar. 1969 31 p refs Transl. into FRENCH from Russian report IFVE-SKU-68-60 In FRENCH
(CERN-Trans-69-11; IFVE-SKU-68-60) Avail: AEC Depository Libraries

The peculiarities of the dynamics for various methods of targeting in the real conditions of the IHEP accelerator are examined. The magnetic field characteristics used in the calculations are taken from the results of measurements in the ring magnet. NSA

N70-13920# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
QUANTUM SPIN WAVES [KVANTOVYYE SPINOVYYE VOLNY]
P. S. Zyryanov et al Jul. 1969 6 p refs Transl. into ENGLISH from Russian Preprint no. 164
(AEC-tr-7063) Avail: CFSTI

The classical theory of spin waves in a nonferromagnetic metal provides for an entire series of restrictions on the possibility of their propagation connected with the existence of collisionless Landau damping. It is shown that due to quantization of the orbital motion of the electrons by a strong external magnetic field, the possibility of the existence of new branches of the spin density oscillation is opened up. NSA

N70-13928# Aktiebolaget Atomenergi, Studsvik (Sweden).
ABSOLUTE TRANSITION RATES IN IR 188
Sven G. Malmskog and Valter Berg (Stockholm Univ.) Sep. 1969 17 p Submitted for publication
(AE-370) Avail: CFSTI

Half-lives of several excited levels in Ir-188 have been measured using an electron-electron delayed coincidence spectrometer. Active Pt-188 sources were prepared from spallation products using the ISOLDE on-line mass separator facility at CERN. The following half-lives were obtained: (54.8 keV level) = (1.93 + or − 0.10) nsec, (96.7 keV level) = (1.59 + or − 0.12) nsec, (187.6 keV level) = (0.056 + or − 0.013) nsec, (195.1 keV level) = (0.051 + or − 0.010) nsec and (478.3 keV level) < or = 0.15 nsec. The 54.8 keV transition was found to have an enhanced E2 transition probability indicating a collective character for this transition. Author (ESRO)

N70-13929# Aktiebolaget Atomenergi, Studsvik (Sweden).
TRANSITION PROBABILITIES IN THE 1/2 PLUS (631) BAND IN U-235
Mats Höjeberg (Stockholm Univ.) and Sven G. Malmskog Sep. 1969 19 p refs Submitted for publication
(AE-371) Avail: CFSTI

Measurements of absolute transition probabilities in the rotational band built on the 1/2(+) (631) single particle state in U-235 have been performed using delayed coincidence technique. The following half-lives were obtained: (13.0 keV level) = (0.50 + or − 0.03) nsec, and 951.7 keV level) = (0.20 + or − 0.02) nsec. From the deduced B(E2) and B(M1) values magnetic and electric parameters were determined which could be compared with predictions from the Nilsson model. Author (ESRO)

N70-13948# Commissariat à l'Energie Atomique, Saclay (France). Department de Metallurgie.
STUDY OF SECONDARY ELECTRONIC EMISSION IN SOME PIEZO-ELECTRIC MATERIALS: APPLICATION TO ULTRASONIC VISUALIZATION [ETUDE DE L'EMISSION ELECTRONIQUE SECONDAIRE DE QUELQUES MATERIAUX PIEZOELECTRIQUES: APPLICATION A LA VISUALISATION ULTRASONORE]
Jean Marini (Ph.D. Thesis–Lyon Univ.) Oct. 1969 167 p refs In FRENCH; ENGLISH summary
(CEA-R-3891) Avail: CFSTI

Methods for the visualization of acoustic images appear at the moment to be of great interest in the field of non-destructive testing as well as in that of underwater detection. In order to carry out certain calculations on the operation of an ultrasonic cine-camera, it has been necessary to study the secondary electron emission of some piezo-electric materials liable to be incorporated into the equipment. The secondary electron emission of insulators is a rather complex phenomenon; in order to find a rational explanation for the observations made, a theory has been developed for the energy spectrum of the emitted electrons. The experimental results of this work have then been used to build an ultrasonic visualization installation. Some examples of acoustic images which have been visualized are also presented. Author (ESRO)

N70-13952 European Organization for Nuclear Research, Geneva (Switzerland). Rings Div.
FEEDBACK DAMPING OF HORIZONTAL BEAM TRANSFER ERRORS
E. Keil, W. Schnell, and P. Strolin 13 Oct. 1969 16 p refs
(CERN-69-27) Copyright. Avail: Issuing Activity

During the transfer from the phase shifter into the ion storage ring (ISR) the proton beam passes two fast kicker magnets. The errors of the magnets induce a horizontal coherent dipole type betatron oscillation of the circulating beam in the ISR with a substantial amplitude. If this oscillation is not corrected while still coherent, it will cause an increase in the radius of the injected beam by the amplitude of the coherent oscillation. However, the coherent betatron oscillation of the bunched injected beam can be detected with pick-up stations and the error signal can be fed back into the beam via a suitable amplifier and correction kicker. A quantitative basis is provided for the discussion of a feedback damping system for horizontal dipole mode injection errors in the ISR. Improvements in operation and performance of the ISR are considered and a method is indicated for practical realization of such a system. R.B.

N70-13959# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
RADIOACTIVE CONTAMINATION IN WORKSHOPS AND LABORATORIES. VOLUME 2: COLLECTIVE PROTECTION TECHNIQUES
J. P. Perotin and B.Werderer Jan. 1968 95 p refs Transl. into ENGLISH from Comm. Energie At. Rappt. (France) 2 SPR/67-558, 1967
(PB-185821T; AERE-TRANS-1105) Avail: CFSTI CSCL 18F

Contents: General properties of contaminants; Characteristics of atmospheric contamination; Trapping contamination; Localization of contamination; Entrainment of contamination; Purification of air; Discharge into the external atmosphere; Contamination of surfaces. USGRDR

N70-13964# City Univ. of New York. Dept. of Chemistry.
RADIO AND RADIATION CHEMISTRY Progress Report, 16 Sep. 1968 – 15 Sep. 1969
Harmon L. Finston 30 Jun. 1969 18 p refs
(Contract AT(30-1)-3417)
(NYO-3417-11) Avail: CFSTI

Progress is reported on: direct determination of fast neutron cross sections, thermal neutron capture cross sections of (n,2n)-produced radionuclides, and application of radioreagents. NSA

N70-13965# California Univ., Livermore. Lawrence Radiation Lab.
EVIDENCE FOR THE FORMATION AND MOTION OF MOLECULAR HYDROGEN IN IRRADIATED LITHIUM HYDRIDE
Herman R. Leider 2 Jul. 1969 8 p refs
(UCRL-50698) Avail: CFSTI

It was reported in a previous study that the motionally narrowed hydrogen seen with pulsed nuclear magnetic resonance in irradiated Li(H-1,H-3) does not have the same isotopic composition as the original lithium hydride. This experiment was repeated with a different isotopic composition to extend the range of the data. The hydrogen that gives rise to the motionally narrowed NMR signal was shown to be in high density gas bubbles that must form by diffusion processes. It is proposed that the difference in isotopic composition is due to the mass dependence in the diffusion coefficient, and arguments are given to support the idea that the diffusing species is molecular hydrogen. Author (NSA)

N70-13976# Kernforschungszentrum, Karlsruhe (West Germany).
CHEMICAL EXPERIMENTS WITH ELEMENT 104-KURCHATOVIUM. PART 2: CHEMICAL INVESTIGATION OF SPONTANEOUS FISSION OF ISOTOPES OF HALF LIFE 0.3 SECONDS [VERSUCHE ZUR CHEMIE DES ELEMENTS 104-KURCHATOVIUM. 2. CHEMISCHE UNTERSUCHUNG DES SPONTAN SPALTENDEN ISOTOPS DER HALBWERTZEIT 0.3 SEKUNDEN]
I. Zvara et al [1969] 29 p refs Transl. into GERMAN from Russian report JINR-P7-3783 In GERMAN
(KFK-tr-291; JINR-P7-3783) Avail: CFSTI

For the purpose of chemical identification and investigation of a spontaneously fissioning nuclide of 0.3 sec half life (obtained in 1964 at Dudna and identified by the nuclear method as Element 104 isotope) the absorption of molecules of its chloride from the gas phase on solid surfaces was compared with that of chlorides of known elements. The chloride is adsorbed aprpoximately in the same way as chloride of Hf, but more than niobium chloride and considerably less than the chlorides of In, Th, Cm, Cf, Fm, and of Element 102. The heat of vaporation of the chloride of Element 104 was estimated to be 16 to 23 kcal/mole. Total of nuclear and chemical data shows that the isotope investigated belongs to the element of the Periodic Table with the atomic number 104, which is close in properties to Hf and must be in subgroup IV B. Author (NSA)

N70-13977# California Inst. of Tech., Pasadena.
REMARKS ON DIFFRACTION SCATTERING
F. Zachariasen Aug. 1969 48 p refs
(Contract AT(11-1)-68)
(CALT-68-201) Avail: CFSTI

The amplitude for diffraction scattering is discussed. Compatibility with unitarity, calculations of f(t), and partial waves are covered. It is pointed out that there exists no plausible theory of diffraction scattering which starts with unitarity, crossing, and analyticity and proceeds to a differential cross section. NSA

N70-13978# Oak Ridge National Lab., Tenn. Neutron Physics Div.
HIGH-ENERGY (LESS THAN 18 GeV) MUON TRANSPORT CALCULATIONS AND COMPARISON WITH EXPERIMENT, PART 2
R. G. Alsmiller, Jr. and J. Barish 21 Jul. 1969 14 p refs Submitted for publication
(PB-185573; ORNL-TM-2669-Pt-2) Avail: CFSTI CSCL 20H

Calculations of the transport of high energy photomuons through a very thick iron shield have been carried out. The results presented differ from those given previously in that the angular distribution of the photons which produce the photomuons is included in the calculations. It is shown that the effect of this angular distribution is small and does not account for the previously reported discrepancy between calculated and experimental results. Author (USGRDR)

N70-13985# Los Alamos Scientific Lab., N.Mex.
CROSS SECTION MEASUREMENTS FOR THE Be-9 PLUS d AND C-12 PLUS t INTERACTIONS
D. D. Armstrong, J. G. Beery, P. W. Keaton, Jr. and L. R. Vesser 7 Aug. 1969 25 p refs
(Contract W-7405-eng-36)
(LA-4177) Avail: CFSTI

Cross sections were measured for the Be-9(d,p)Be-10, Be-9(d,d)Be-9, and Be-9(d,t)Be-8 reactions at 15.0 MeV; for the C-12(t,p)C-14, C-12(t,d)C-13, C-12(t,t)C-12, and C-12(t,alpha)B-11 reactions at 16.0 and 20.0 MeV; and for C-12(t,t)C-12 scattering at 14.0 MeV. Author (NSA)

N70-13987# Commissariat à l'Energie Atomique, Marcoule (France). Centre de Production de Plutonium.
CHANGES IN THE PROCESSING OF HEAVY ALPHA-CONTAMINATED EQUIPMENT AT THE MARCOULE CENTRE [L'EVOLUTION DU CONDITIONNEMENT DES GROS MATERIELS CONTAMINES EN ALPHA SUR LE CENTRE DE MARCOULE]
Philippe Seyfried Sep. 1969 21 p refs In FRENCH; ENGLISH summary
(CEA-R-3785) Avail: CFSTI

The processing of heavy alpha-contaminated equipment at the Marcoule Centre has been carried out for a long time by a rather expensive 'manual' method. It has become necessary to reduce these costs by using more automated methods. Two studies which have been carried out have shown that when the amount of waste to be treated is large and is composed mainly of plastic material, it is possible to design economic installations using cooling and shock demolition as conventional compaction leading to rather poor results. For average quantities, a cutting-up reservoir, also used for other purposes, makes it possible to solve these processing problems at Marcoule. The costs involved are much lower than those previously required in the case of so-called 'manual' methods. Author (ESRO)

N70-13988# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
CYCLOTRONIC RESONANCE [LA RESONANCE CYCLOTRONIQUE]
Jean-Bernard Robert Sep. 1969 27 p In FRENCH; ENGLISH summary
(CEA-BIB-163) Avail: CFSTI

Cyclotronic resonance uses the properties of motion of a charged particle subjected simultaneously to a constant magnetic induction and an alternating linear electrical field. Numerous applicationsoapplications of this technique have been made in various fields, particularly in the study of interactions between electrons and neutral molecules, and between ions and neutral molecules in the gas phase and also in the determination of reaction sequences by double resonance. This report actually reviews recent work in these fields and lists 58 papers. Author (ESRO)

N70-13989# Rome Univ. (Italy). Inst. of Physics.
ON PION ELECTROPRODUCTION AT 5 F SUP MINUS 2 NEAR THRESHOLD
E. Amaldi, M. Balla (Pisa Univ.), B. Borgia, G. V. di Giorgio (Pisa Univ.), A. Giazotto (Pisa Univ.) et al 8 Jul. 1969 42 p refs Prepared Jointly with Ist. Nazl. Fis. Nucl. *Its* Nota Interna No. 229
Avail: CFSTI

A coincidence experiment designed for determining the electroproduction cross section at threshold is described. By using a formula derived by De Tollis and Nicolo, the limits for the pion (+) electromagnetic form factor are deduced from the cross section at the threshold given above. The same data were analyzed in terms of a formula deduced by Gleeson et al by means of current algebra techniques and PCAC assumption, which allows a determination of the mass appearing in the nucleon axial-vector form factor. The

measurements are in good agreement with the usually accepted value. From the measurements of the pion (–) electroproduction only a very low upper limit of the cross section at threshold can be derived. The cross section, however, increases rapidly with q reaching a value equal to about 30% of the pion (+) cross section already at q around 50 MeV/c. Author (ESRO)

N70-13998# Scientific Translation Service, Ann Arbor, Mich.
CONTROL OF THE HOMOGENEITY OF COLAMINATED PLATES BY PHOTOMETRY
Marie Therese Destribats et al. [1969] 17 p refs Transl. into ENGLISH from CEA-CONF-1079 Prepared for ORNL
(ORNL-tr-2131; CEA-CONF-1079) Avail: CFSTI

The apparatus for the automatic inspection of U distribution in laminated plates by photometry of the radiograph is described. The problem of opacity is overcome by radiographing either side of the fuel plate and the entire length with two standards corresponding to the minimum and maximum contents in terms of density. The opacity of each point on the radiograph is then compared with the opacity of the standards, at points located in the same transverse plane. Advantages of this method and its accuracy are described. Author (NSA)

N70-14005# Commissariat à l'Energie Atomique, Marcoule (France). Centre de Production de Plutonium.
NUCLEAR ENERGY: ACCIDENTS AND INCIDENTS [L'ENERGIE NUCLEAIRE: ACCIDENTS ET INCIDENTS]
Yves Sutra-Fourcade Oct. 1969 153 p refs In FRENCH; ENGLISH summary
(CEA-BIB-164) Avail: CFSTI

The present document updates a 1964 report on incidents in reactors and in nuclear installations. The known incidents and accidents which occurred in nuclear installations up to 1968 are listed. Incidents occurring during transport of radioactive materials, in hospitals or private establishments, and incidents which involved radioactive materials in nuclear submarines, bombers carrying nuclear war-heads, bomb tests, etc. have been added. Categories of incidents considered are critical incidents and power excursions of critical assemblies, nuclear reactors and chemical processing installations, rupture in nuclear reactors, various incidents in nuclear reactors, incidents during transport of radioactive materials, incidents during testing of nuclear devices and other incidents. Accidents whose number is marked with an asterisk are described in somewhat more detail in the second part of the report. Author (ESRO)

N70-14017# Scientific Translation Service, Ann Arbor, Mich.
ENERGY DEPENDENCE OF INTERACTION CROSS SECTIONS OF NUCLEONS WITH ATOMIC NUCLEI AT ENERGIES HIGHER THAN 50 MeV
V. S. Barashenkov et al. 1968 13 p refs Transl. into ENGLISH from the Russian Report Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-2148; JINR-P2-4183) Avail: CFSTI

The curves of the energy dependence of the integral cross sections are given for the interactions of protons with Be, C, Al, Ti, Fe, Cu, Cd, Pb, and U nuclei. Author (NSA)

N70-14020# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
EXCITED STATES IN MOLECULES OF BIOLOGICAL INTEREST [ETATS EXCITES DANS LES MOLECULES D'INTERET BIOLOGIQUE]
Pierre Nounou Oct. 1969 30 p refs In FRENCH; ENGLISH summary
(CEA-BIB-162) Avail: CFSTI

A knowledge of the excited states and their distribution, resulting from the first effect of radiation on biological molecules enables one to understand the radiation effect on living substances. Among different types of possible states of a molecule, emphasis was placed on the study of triplet states and the different theories which can explain most of the non-radiative transitions. As a result phonon-theories, exciton-theories concerning helicoidal polynucleotides, phosphorescence, and photochromic effects have been considered. A brief description of the principal experiments for the observation of these effects, particularly flash-photolysis and flash-spectroscopy, are also given. Author (ESRO)

N70-14033# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
PHASE-SHIFT ANALYSIS OF PION-NUCLEON ELASTIC SCATTERING BELOW 1.6 GeV [ANALYSE EN ONDES PARTIELLES DE LA DIFFUSION ELASTIQUE MESON PI-NUCLEON AU-DESSOUS DE 1,6 GeV]
Pierre Bareyre (Ph.D. Thesis-Paris Univ.) Jul. 1969 80 p refs In FRENCH; ENGLISH summary
(CEA-R-3578) Avail: CFSTI

Experimental results of pion-nucleon elastic scattering below 1.6 GeV for total cross sections, angular distributions of elastic scattering and recoil nucleon polarizations have been analysed by a partial wave technique. This analysis has been developed, one energy at a time, with a least squares method and a single solution was extracted by continuity with energy of the different solutions. Resonating behaviour has been clearly established for several partial waves. In addition to these important effects some phase shifts show rapid variations with energy, but it cannot yet be stated whether these variations are due to experimental biases or to physical effects. Author (ESRO)

N70-14034# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
THREE POINT FUNCTIONS AND A SUM RULE FROM RADIATIVE CORRECTIONS TO PION BETA DECAY: A UNIFIED DESCRIPTION OF LOW ENERGY MESON PHENOMENA
Hiroshi Namaizawa (Ph.D. Thesis) Sep. 1969 70 p refs
(RIFP-93) Avail: CFSTI

Combining CVC, PCAC and meson dominance approximation we develop a theory of current algebra on the-mass-shell by means of Ward-Takahashi type identities for three point functions. Models of mixing are presented which are compatible with the spectral function sum rules derived from breaking chiral symmetry and with CVC to the first order of symmetry breaking. Further, requiring absence of divergences from radiative corrections to pion beta-decays, we deduce an asymptotic sum rule which relates two different types of three point functions and thus enables us to correlate two different meson processes; radiative and strong decays. In addition to these decay processes, applications are carried out to electromagnetic form factors of mesons. Agreement with experiments is very reasonable. Author

N70-14041# Brookhaven National Lab., Upton, N.Y.
NUCLEAR ENGINEERING DEPARTMENT Annual Report, 1 Dec. 1968
31 Dec. 1968 152 p refs
(BNL-50149) Avail: CFSTI

Results are reported for neutron scattering data recorded for molten salts, radiation effects on various compounds, effects on solvent extraction of various elements in an acetate-citrate system using TTA, heat transfer research on different liquid metals, corrosion and mass transfer by liquid sodium, a data storage and retrieval system for neutron cross sections, physics parameter measurements on critical assemblies, neutron scattering measurements in fast reactor cores, and power generation rates in pressurized water reactors. NSA

N70-14043# California Univ., Berkeley. Lawrence Radiation Lab.
THE OMEGA RHO INTERFERENCE EFFECT
G. Goldhaber, W. R. Butler, D. G. Coyne, B. H. Hall, J. N. Mac Naughton et al Jun. 1969 53 p refs Presented at Conf. on Pion-Pion and Kaon-Pion Interactions, Argonne, Ill. 14 – 16 May 1969 and at Lund Intern. Conf. on Elementary Particles, Lund,Swed., 25 Jun. – 1 Jul. 1969
(Contract W-7405-eng-48)
(UCRL-18894; Conf-690521-4; CONF-690608-7) Avail: CFSTI

A phenomenon interpreted as the omega rho interference effect which occurs as destructive interference in pion-proton reactions from a separated meson beam interacting in a bubble chamber is discussed. The momenta varied between 3.7 and 4.0 GeV/c. NSA

N70-14046# Brookhaven National Lab., Upton, N.Y.
GIRD: COMPUTER PROGRAM FOR DESIGN OF SHUFFLE-DWELL GAMMA IRRADIATORS
L. Galanter, S. Rosen, F. X. Rizzo, and L. Bargiuk Mar. 1969 53 p refs
(BNL-50148) Avail: CFSTI

The shuffle-dwell irradiator is a system in which targets are rapidly moved laterally past one or more rectangular radiation sources and reside or dwell at a number of fixed positions on one or both sides of the source for a fixed period of time. Factors involved in optimum design of the irradiator include source economy, dose uniformity within product, product package shape and size, and product throughout. To encompass these factors, the GIRD code was written for the CDC-6600. It was specifically written to solve the meat irradiator design problems. NSA

N70-14047# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
A SHORT-LIVED ISOMER IN At-203
T. Morek, T. Noibert, S. Khoinatskii, K. Aleksander, and Z. Vilgelmi 1969 3 p refs In RUSSIAN
(JINR-P6-4494) Avail: AEC Depository Libraries

In the reactions Au197(12C,6n)203t A and Ir191(O18,6n)203At an isomeric level with a half-life of 108 + or – 10 msec was found. The multipolarity of the 585-keV transition to the ground state is E3. Furthermore gamma rays with energies 426, 682, and 516 keV following the beta decay of At204 were observed. Possible interpretations for the isomerism in At203 are discussed. Author (NSA)

N70-14052# Wyoming Univ., Laramie.
NUCLEAR PHYSICS STUDIES USING NUCLEAR EMULSIONS Technical Progress Report, 6 Nov. 1968 – 31 Oct. 1969
10 Aug. 1969 48 p refs
(Contract AT(11-1)-1549)
(COO-1549-15) Avail: CFSTI

The absolute efficiency of various size Ge(Li) gamma ray detectors in the 60 to 2734 KeV energy range was determined. Neutron activation analysis and scintillation counting of vanadium in residual oils are described as well as gamma ray spectrum measurements of Ga-64, and 37.7 MeV helium 3 induced reactions in zinc. Neutron spectrometer fabrication, excitation function calculations, neutron emission from heavy ion bombardment, and charged particle spectra measurements are also disucssed. J.A.M.

N70-14060# Addis Translations International, Woodside, Calif.
MOTION OF PARTICLES IN THE ADGEZATOR
I. N. Ivanov et al [1969] 49 p refs Transl. into ENGLISH from the Russian Prepared for Calif. Univ.,Berkeley
(UCRL-TRANS-1390; JINR-P9-4132) Avail: CFSTI

Main conditions which the bunch must satisfy and the method of producing them; quasistationary states of the electron ring, intrinsic fields and forces in the ring; equations and constants of motion; and two distribution functions are discussed. Also, analysis of the adiabatic behavior of a beam; accelerating field as a function of the adgezator parameters; wall screening effects; contribution of resonances; ion injection; and extraction of the electron ring from the adgezator are considered. NSA

N70-14067# Stanford Linear Accelerator Center, Calif.
SPEAR DESIGN REPORT: STANFORD POSITRON ELECTRON ASYMMETRIC RINGS
Aug. 1969 54 p refs
(Contract AT(04-3)-515)
(TID-25186) Avail: CFSTI

The conceptual design for the Stanford Positron – Electron Asymmetric Rings is presented. Two beams circulate in independent rings and interact in two regions where they cross with a comparatively large horizontal angle. A cost estimate and schedule and a parameter summary are included. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-12760# Innsbruck Univ. (Austria). Inst. for Theoretical Physics
DISSIPATIVE INSTABILITIES OF AN MHD SHEET FLOW
Ernst H. Jager 30 Jun. 1969 19 p refs
(Contract F61052-67-C-0014)
(AD-693405; UNICP-SR-65; AFOSR-69-2321TR) Avail: CFSTI CSCL 18/1

The stability of a sheet of flowing, non-ideal plasma is examined within linearized MHD. A general equation is obtained for the velocity perturbation of an assumed, non-static equilibrium. With all the equilibrium quantities constant, this equation gives the usual dissipative instabilities. A constant equilibrium flow velocity does not change the situation. Preliminary results obtained with variable (in space) equilibrium quantities are briefly discussed. They seem to indicate that a velocity profile across the sheet affects its stability in a new way. Author (TAB)

N70-12779# California Univ., Los Angeles. School of Engineering and Applied Science.
AN ARC-HEATED Ar-He BINARY SUPERSONIC MOLECULAR BEAM WITH ENERGIES UP TO 21 eV
Wen-Shean Young Jul. 1969 147 p refs
(Grants NSF GK-1854)
(PB-185864; UCLA-69-39) Avail: CFSTI CSCL 14B

A molecular beam apparatus comgining the aerodynamic acceleration and arc heating techniques was developed. Semiempirical equations which predict the beam density and the beam energy were derived. An energy of 21 eV and a density of 4 × 10 to the 9th molecules/cu cm were experimentally observed for argon accelerated by helium. The phenomenon of species separation associated with expansions of a binary mixture in a free jet and thermal diffusions due to arc heating is also investigated. A magnetoplasmadynamic arc heater was developed. A novel dual-disk time-of-flight (TOF) chopper was introduced. Analytical expression relating the dual-disk TOF signals to the density and the pertinent parameters of the speed distribution function of the beam were derived. Author (USGRDR)

N70-12782# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
TURBULENT HEATING STUDIED BY MICROWAVE SCATTERING
C. B. Wharton, D. S. Prono, and F. Sandel 1 May 1969 5 p refs Presented at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, 12 6 Sep. 1969
(Contract AT(30-1)-3958)
(CU-3958-2; CONF-690803-15) Avail: CFSTI

The plasma is generated in two pulsed conical pinch guns and injected simultaneously into each end of a static 2:1 magnetic mirror field of 0.22 Tesla. Turbulent heating is produced by applying an 80 KV pulse between two electrodes 150 cm apart, so that 3000 to 5000 amperes flow along the magnetic field for ~0.8 musec. While the plasma is turbulent, its resistivity is anomalously high and the plasma column expands radially at a rapid rate. A spectrum of plasma waves is formed, having strong peaks at certain frequencies. After the heating pulse one finds that the ions have gained 500 eV of perpendicular energy, and the plasma is confined in the magnetic mirrors. The turbulence spectrum during the heating pulse was studied by microwave scattering at wavelengths of 7.5 and 4.8 mm. The main conclusions are that angularly dependent scattering was seen, with amplitude peaks at frequencies encompassing the ion cyclotron frequency, the ion plasma frequency, the electron plasma frequency and other frequencies. Author (NSA)

N70-12794# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
INVESTIGATIONS IN PLASMA DYNAMICS Annual Progress Report
George Schmidt Jul. 1969 11 p refs
(Contract AT(30-1)-3785)
(SIT-3785-9; SIT-239) Avail: CFSTI

Nonlinear wave–particle interaction in a transverse wave propagating along a uniform magnetic field was investigated. Minor studies on adiabatic invariants and magnetically confined electron plasmas were also made. NSA

N70-12812# California Univ., Livermore. Lawrence Radiation Lab.
USE OF A NEUTRAL HELIUM BEAM IN PLASMA DIAGNOSTICS
M. A. Lieberman 7 Jul. 1969 25 p refs
(Contract S-7405-eng-48)
(UCRL-50638) Avail: CFSTI

The use of a neutral helium beam to diagnose the electron temperature and density of the 2X plasma is proposed. The temperatures and densities of interest probably lie in the ranges 75 to 1000 eV and 1 × 10 to the 12th power to 5 × 10 to the 13th power/cc respectively. In the proposed experiment, a neutral helium beam is passed through the plasma. The plasma electrons excite neutral helium, producing optical radiation. The electron density and temperature can be determined by absolute and relative measurements of the optical intensities of selected spectral lines. Good spatial and time resolution can be achieved in these measurements. Author (NSA)

N70-12848*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE IONIZATION INSTABILITY OF PLASMA WITH HOT ELECTRONS [IONIZATSIONNAYA NEUSTOYCHIVOST PLAZMY S GORYACHIMI ELEKTRONAMI]
Ye. D. Velikhov et al Washington NASA Nov. 1969 13 p refs Transl. into ENGLISH from Proc. of 7th Intern. Conf. on Phenomena in Ionized Gases, Belgrade, 1965 p 675–681
(Contract NASw-1692)
(NASA-TT-F-12684) Avail: CFSTI CSCL 20I

This paper discusses the instability and turbulence of dense plasma flow with hot electrons interacting with a magnetic field. An examination of current disturbances perpendicular to the magnetic field makes it possible to propose various stabilization methods. However, due to the fact that turbulent ionization must be accepted, no definite conclusions were able to be drawn, and further study is necessary to determine the feasibility of these methods for stabilizing ionization. Author

N70-12882# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
PLASMA INSTABILITIES AND WAVES EXCITED BY AN ANISOTROPIC ENERGY DISTRIBUTION PRODUCED BY ELECTRON CYCLOTRON RESONANCE Quarterly Progress Report
J. L. Shohet 15 Jun. 1969 23 p refs
(Contract AT(11-1)-1695)
(COO-1695-19; QPR-9) Avail: CFSTI

Theoretical work on developing an expression for the free-free bremsstrahlung from a plasma containing an anisotropic electron energy distribution was continued. The two areas under investigation are: (1) to write an energy distribution function for electrons in a plasma when the energy distribution of electrons is anisotropic and some of the electrons have relativistic velocities; (2) using this energy distribution function, calculate the free-free bremsstrahlung emission pattern from the plasma. The plasma simulation work continued with computations for the conditions of electron cyclotron resonance, periodic boundary conditions, RF confinement (no magnetic fields), and cold plasma (zero-temperature models). NSA

N70-12883# Academy of Sciences (USSR), Moscow. Inst. Fiziki.
STUDIES OF QUASI-STEADY ELECTRIC FIELDS AND PLASMA OSCILLATIONS IN A STELLARATOR L-1
M. S. Berezhetskii, S. E. Grebenshchikov, I. A. Kossyi, Yu. I. Nechaev, M. S. Rabinovich, et al 1968 23 p refs Transl. into ENGLISH from Russian report
(AEC-TR-7054) Avail: CFSTI

Containment of low pressure noncollisional plasma and processes responsible for plasma escape from the trap are investigated. Quasi-steady electric fields and plasma oscillations induced by external injection and their relation to the plasma lifetime were studied using a two-inlet (l = 2) Liven'-1 stellarator. Data obtained indicated influence of the structure of magnetic surfaces on plasma diffusion. Moreover, the influence was exerted not only by the confining surfaces themselves, but also, by their fine structure. The appearance of magnetic discontinuities affected macroscopic plasma parameters (confinement time and potential). The experiments did not reveal the cause of increased plasma diffusion the L-1 stellerator, but they confirmed the importance of the stellarator magnetic field and magnetic surface fine structure on confinement of plasma. NSA

N70-12872# California Univ., Livermore. Lawrence Radiation Lab.
NUMERICAL CALCULATIONS OF PLASMA HEATING BY MEANS OF SUBNANOSECOND LASER PULSES
J. W. Shearer and W. S. Barnes 26 May 1969 48 p refs Presented at Laser Interaction and Related Plasma Phenomena Meeting, East Windsor Hill, Conn., 9-13 Jun. 1969 Submitted for publication
(UCRL-71733; CONF-690622-1) Avail: CFSTI

Numerical computer techniques have been used to calculate plasma heating by means of focused subnanosecond pulses at the neodymium laser wavelength. The plasma is treated as a single fluid in the hydrodynamic equations, but the electrons and ions may be at different temperatures. Thermal diffusion, electron-ion interaction, and free-free radiation emission are included. The linear

equation for the absorption of laser light is derived from the free-free equation, and its properties are shown to lead to the consequence that a laser-produced plasma should be described by a coronal type of equation of state. The calculation technique is applied to various experimental situations, including the recent lithium deuteride thick target neutron detection experiments, and the results are presented. Author (NSA)

N70-12873# Princeton Univ., N.J. Plasma Physics Lab.
THE USE OF A STIX COIL FOR ION CYCLOTRON RESONANCE HEATING IN A NON-UNIFORM MAGNETIC FIELD
R. M. Sinclair, M. A. Rothman, and J. C. Hosea Apr. 1969 8 p ref
(Contract AT(30-1)-1238)
(MATT-681) Avail: CFSTI

Ion cyclotron resonance heating in the model C stellarator is limited at high power levels by the rapid decrease in plasma density under the induction coil, and the narrow range of density over which significant energy can be coupled to ion cyclotron waves. In an effort to couple more energy to the plasma, the normally constant confining field was modified to vary linearly by < or = to 30% over the length of the coil. Although it was possible to couple energy to the plasma over a somewhat broader range of density in the nonuniform field, no improvement in heating efficiency or plasma temperature was achieved compared with that obtained with the uniform field. Author (NSA)

N70-12880# Atomic Energy Commission, Washington, D.C.
ON THE THEORY OF PARAMETRIC INTERACTION OF A SUPERHIGH FREQUENCY FIELD WITH A PLASMA
V. P. Silin [1969] 20 p refs Transl. into ENGLISH from Akad. Nauk SSSR (Moscow), 1969 p 1-31 *Its* Preprint 22
(AEC-TR-7078) Avail: CFSTI

Equations have been developed describing the evolution of the distribution of particles and of an unbalanced field in a turbulent state of plasma, developing during the parametric effect of a powerful superhigh frequency field. The application of the theory to the case of the kinetic instability of the non-isothermal plasma, caused by the Cherenkov effect on the electrons, indicates an anomalous increase in the dissipative high-frequency conductivity of the plasma, associated with the increase in the intensity of the plasma oscillations. Author (NSA)

N70-12938# Oak Ridge National Lab., Tenn.
BASIC INTERACTION PRODUCING PLASMA HEATING IN THE OAK RIDGE NATIONAL LABORATORY MODE 2 PRESSURE GRADIENT ARC
Igor Alexeff and William Denver Jones 6 Jun. 1969 11 p Submitted for publication Sponsored by AEC
(PB-185615; ORNL-TM-2661) Avail: CFSTI CSCL 20L

Using small high frequency probes and recently developed high frequency correlation techniques, we have tentatively identified the basic interaction mechanism leading to plasma heating in the Oak Ridge National Laboratory Mode-II pressure gradient arc as the excitation of extremely intense Langmuir oscillations along the magnetic field inside the hollow, plasma filled anode by an electron beam. Author (USGRDR)

N70-12974# Oak Ridge National Lab., Tenn.
MULTIPLE PSEUDOWAVES PRODUCED BY A SINGLE VOLTAGE PULSE
I. Alexeff, W. D. Jones, and M. Widner 22 Jul. 1969 22 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2656) Avail: CFSTI

A multiple pseudowave - or a series of fast ion bursts - is generated when a short negative voltage pulse is placed on a transparent grid immersed in a plasma. The phenomenon resembles, but is not, a damped wave train. It is shown, using a single particle model, that multiple pseudowaves can be explained in terms of ions trapped and oscillating in the ion sheath formed around the grid by the negative voltage pulse. A pulsed grid used in this manner constitutes a simple diagnostic technique for measuring plasma density. Author (NSA)

N70-13010# Academy of Sciences (USSR), Moscow.
PLASMA RADIATION MECHANISM IN ASTROPHYSICS
S. A. Kaplan and V. N. Tsytovich 1968 90 p refs In RUSSIAN *Its* Preprint No. 65
(NP-17701) Avail: AEC Depository Libraries

Chapters 1, 2, and 4 are devoted to the theory of plasma radiation mechanisms and classification of plasma mechanisms by emission frequencies. Chapters 3 and 5-11 discuss various aspects of the conversion of plasma waves into electromagnetic waves during: (1) scattering on thermal ions and electrons in isotropic plasma; (2) scattering on epithermal nonrelativistic ions and relativistic electrons; (3) Compton scattering; (4) nonlinear scattering on relativistic ions; and (5) scattering on epithermal and relativistic ions. The last and twelfth chapter treats plasma radio-emission mechanisms in radioastronomy. NSA

N70-13013# Sydney Univ. (Australia). School of Physics.
PROBE INTERFEROMETER MEASUREMENT OF ELECTRON DENSITY DISTRIBUTION IN A DECAYING HYDROGEN PLASMA
G. F. Brand and N. R. Heckenberg Mar. 1969 13 p refs
(NP-17977; ER-43) Avail: AEC Depository Libraries

A simple system capable of measuring directly the electron density profile across a plasma was developed and used to investigate the afterglow of a hydorgen plasma. The circuit consists of three ordinary-wave interferometers. The probe interferometer operates at 35 GHz over a variable path length. NSA

N70-13048# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT Semiannual Progress Report, 1 Jan. - 30 Jun. 1969
30 Jun. 1969 8 p
(NP-17989; SAPR-17) Avail: CFSTI

A brief discussion of research is given for the following: (1) plasma sources, (2) hydromagnetic ionizing fronts, (3) plasma centrifuge, (4) decay in a plasma, (5) hydromagnetic wave propagation in axially nonuniform mangetic fields, (6) laser diagnostics, and (7) far infrared laboratory Author (NSA)

N70-13070# Joint Publications Research Service, Washington, D.C.
IONOSPHERIC AERODYNAMICS
A. V. Gurevich et al 1 Dec. 1969 70 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 99, no. 1, 1969 p 3-49
(JPRS-49350) Avail: CFSTI

Results of research since 1964 on the theory of flow of a rarefied ionospheric plasma around moving bodies are reviewed. Emphasis is placed on the problem of the effect of an electric field produced in the plasma by the moving body. Equations are developed to express the plasma flow around a halfplane, wedge, rounded edge, plate cylinder, disk, and sharply elongated bodies. The effect of the electric fields on ion motion is calculated, and the plasma instability in the wake is considered. Calculations which take into account the finiteness of the Debye radius are discussed, and results of experimental investigations of the disturbed zone in the vicinity of rockets and satellites are presented. N.E.N.

N70-13074# Atomic Energy Commission, Washington, D.C.
STUDIES OF ELECTRON HEATING MECHANISM DURING ELECTRON BEAM INTERACTIONS WITH PLASMA
A. N. Karkhov Jul. 1969 31 p refs Transl. into ENGLISH from Russian report IAE-1630
(AEC-TR-7065; IAE-1630) Avail: CFSTI

Studies were made of conditions of electron heating and spectral oscillations excited in plasma by electron beams. Data obtained indicate that the circularly polarized electromagnetic waves propagating along the external magnetic field are responsible for electron heating. Author (NSA)

N70-13092*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A CRITICAL ANALYSIS OF THE GRAD APPROXIMATION FOR CLOSING OUT THE MAGNETOHYDRODYNAMIC EQUATIONS FOR PLASMAS
Willard E. Meador Washington Dec. 1969 38 p refs
(NASA-TR-R-325; L-6523) Avail: CFSTI CSCL 20I

A critical analysis is made of the utility of Grad's 13-moment distribution functions in closing out the generalized magnetohydrodynamic equations for plasmas. In particular, the inaccurate particle velocity dependence of the Grad approximation is shown to yield significant errors in the collisional transfers of such quantities as momentum and energy as functions of the moments (variables of the problem) considered. These errors directly affect the relations between moments which are derived by means of the aforementioned closing-out process; consequently, when the Grad functions are written so as to incorporate the moment relations, considerable doubt is cast upon the ability of such functions not only to describe the original 13 moments but also to predict accurately other plasma properties as well. Numerous comparisons with the exact first- and second-order perturbation solutions of the Boltzmann equation are made in order to substantiate these conclusions. A study also is made of the convergence of Grad-type functions as more moments are added, in consequence of which at least 16 moments are often necessary. Author

N70-13101# Atomic Energy Commission, Washington, D.C.
ON THE POSSIBILITIES FOR USING HIGH-CURRENT RELATIVISTIC BEAMS IN PLASMA PHYSICS
V. N. Tsytovich Jul. 1969 28 p refs Transl. into ENGLISH from Akad. Nauk SSSR report Inst. Fiz. Preprint No. 23
(AEC-tr-7061) Avail: CFSTI

Studies on the following are described: (1) instability of relativistic beams in a plasma, (2) normal and anomalous scattering of light by a relativistic beam, (3) possibility for amplification of uv and gamma quanta by a beam of relativistic electrons in the presence of a high-intensity light beam, (4) the Cherenkov laser, (5) resonant buildup of electromagnetic waves in lines and evaluation of the effectiveness of excitation of levels by a relativistic beam, and (6) the synchrotron laser and synchrotron instability. NSA

N70-13188# Atomic Energy Commission, Washington, D.C.
THEORY OF EQUILIBRIUM AND STABILITY OF A HIGH-CURRENT SELF-COMPRESSED DISCHARGE IN AN OPTICALLY DENSE PLASMA WITH RADIATIVE THERMAL CONDUCTIVITY
A. A. Rukhadze et al [1969] 57 p refs Transl. into ENGLISH from Russian report NP-17748
(AEC-tr-7050; NP-17748) Avail: CFSTI

A theoretical analysis is given of the equilibrium and stability of a high-current pulsed discharge in optically dense plasma of strong radiant thermal conductance. Cases of simple cylindrical discharge (Z pinch) and inverse axial current discharge (inverse pinch) were studied. Increments of screw- and kink-type instabilities were calculated for high- and low-conducting plasma. Discharge parameters for a continuous discharge stability necessary when used as a source of light were determined. Problems of unsteady discharge are discussed and the time required for establishing equilibrium in the discharge was evaluated. Author (NSA)

N70-13190# Institute of Nuclear Research, Warsaw (Poland).
STUDIES ON SOME PROPERTIES OF PLASMA SPRAY POWDERS [BADANIA NIEKTORYCH PARAMETROW PROSZKOW STOSOWANYCH DO NAPYLANIA PISTOLETEM PLAZMOWYM]
H. Derko and M. Laskowski 1968 33 p refs In POLISH; ENGLISH summary
(INR-1028) Avail: CFSTI

Investigations are described on diverse parameters relative to imported spray powders which are designed to be used for Plasma Flame spray process. The measurements are carried out using standard methods. The results obtained are the basis of information to facilitate estimation of the suitability of powders for Plasma Flame Spray process. Author (NSA)

N70-13233# Academy of Sciences (USSR), Moscow. Inst. Fiziki.
STABILITY OF NONUNIFORM ELECTRON BEAMS AND THE PROBLEM OF CURRENT LIMITS IN ACCELERATORS
L. S. Bogdankevich, I. I. Zhelyazkov, and A. A. Rukhadze Jul. 1969 18 p refs Transl. into ENGLISH from a Russian report
(AEC-TR-7064) Avail: CFSTI

The stability of a relativistic electron beam in space accelerated by an inhomogeneous electric field is investigated under the conditions where the transverse dimensions of the beam is appreciably greater than the Debye radius, and a collective investigation is required for description of small oscillations. For currents exceeding the critical current, an instability can develop which is analogous to the slipping instability of nonrelativistic electron beams with a nonuniform velocity profile. The conditions of the instabilities are obtained, and the increments in their growth are calculated both in the absence of and the presence of a strong longitudinal magnetic field. The energy scattering of the electrons has a stabilizing effect on the investigated instability of the beam. In the appendix to the article it is shown that the slipping instability is characteristic of any inhomogeneous plasma flow. In particular, it can develop in an isotropic plasma with flow velocities exceeding the thermal velocity of the ions. Author (NSA)

N70-13258# Sandia Corp., Albuquerque, N.Mex. Technical Translation Service.
OPTICAL AND ELECTRICAL MEASUREMENTS OF CONFINED EXPLODING WIRES [OPTISCHE UND ELEKTRISCHE MESSUNGEN AN VERDAEMMTEN DRAHTEXPLOSIONEN]
H. Jaeger et al 8 Oct. 1969 21 p refs Transl. into ENGLISH from Inst. fuer Exptl.-Phys. der Univ. Kiel (Kiel), v. 26, no. 3 1968 p 231–238 Sponsored by AEC
(PB-186208T; SC-T-69-1048) Avail: CFSTI CSCL 19D

Wires threaded axially within tubes of dielectric material are exploded and the radiation temperature of the plasma is determined. Energy and power inputs are evaluated from simultaneous current and voltage oscillograms. It is shown that with decreasing cross section of the inner diameter of the tubes the maximum temperature of the plasma can easily be increased up to 50%. Soon after that a saturation value is reached caused by evaporation of the confining material and an increase of the number of particles. According to a rough estimation pressures higher than 10,000 atmospheres can be obtained, which seems to be susceptible to even further increase under suitable experimental conditions. Author (USGRDR)

N70-13273# Princeton Univ., N.J. Plasma Physics Lab.
ELECTRON DISTRIBUTION FUNCTIONS IN WEAKLY IONIZED PLASMAS
Ira B. Bernstein (Yale Univ.) Nov. 1968 53 p refs

(Contract AT(30-1)-1238)
(MATT-640) Avail: CFSTI

The theory of the electron distribution function in a weakly ionized gas is developed by means of a perturbation expansion in powers of a small parameter which is essentially the sum of the fractional energy gain per electron per mean free time and the ratio of mean free path to macroscopic scale length. This permits not only a very rapid derivation of well-known results, but also the demonstration of various formal properties of the lowest significant-order equation. The boundary conditions on the leading term of the perturbation expansion are derived by means of a boundary-layer analysis from those on the unexpanded distribution function, in a simple situation. An extension of the method, which also incorporates the Chapman - Enskog method as a limit, is sketched. Author (NSA)

N70-13278# Oak Ridge National Lab., Tenn.
EFFECTS OF INTRODUCING SUPPORTS IN A LEVITATED TOROIDAL QUADRUPOLE
W. L. Stirling, M. Roberts, and I. Alexeff Aug. 1969 10 p refs
(PB-186070; ORNL-TM-2701) Avail: CFSTI CSCL 20I

The purpose of the work was to determine the effect of supports introduced into our levitated toroidal quadrupole. Using double probe techniques, there was found no measurable effect on the probe flux, the electron temperature, and the plasma lifetime, for a support size less than 5 mil diameter. Author (USGRDR)

N70-13291# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.
DESIGN OF THE TOKAMAK TM-2 DEVICE
D. P. Ivanov, K. A. Razumova, and A. M. Us Jul. 1966 25 p refs Transl. into ENGLISH from Russian report
(MATT-TRANS-88) Avail: CFSTI

The TM-3 device was designed to obtain a magnetic field up to 50 kOe in magnitude with highly regular geometry. The device has the shape of a circular torus with a large radius R = 40 cm and an inside radius of the discharge chamber a sub 0 = 10 cm. The power system, magnet coils, and toroidal chamber are described. NSA

N70-13295# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
HYDRODYNAMIC THEORY OF STABILITY OF LAMINAR FLUX OF DENSE PLASMA [GIDRODINAMICHESKAYA TEORIYA USTOYCHIVOSTI SLOISTOGO POTOKA PLOTNOY PLAZMY]
I. S. Baikov [1969] 21 p refs Transl. into ENGLISH from Russian report NP-17760
(AEC-tr-7071; NP-17760) Avail: CFSTI

Stability of a dense inhomogeneous plasma flowing along a strong magnetic field at varying velocities was studied, using a two-liquid hydrodynamic model. A dispersion equation for determining the spectrum of the small potential of plasma oscillations was obtained within the approximation limits of geometric optics. It was shown that, in the presence of phase resonance between the flow rate and acoustic or drift waves in a dense plasma with a large number of collisions, low-frequency instabilities were induced by the flow-rate gradient increase. The increases of these instabilities are capable of significantly exceeding the plasma drift frequencies. The influence of the finite thermal conductivity and plasma viscosity on the increase of oscillations was analyzed. At large flow rate gradients such instabilities are not stabilized by the weak crossing of magnetic field lines and, therefore, they present a serious danger to the problem of magnetic confinement of plasma flow and may induce flow turbulence at a rate below the Alfven rate of flow. NSA

N70-13328# Stanford Univ., Calif. Inst. for Plasma Research.
COMPACT NON-ITERATIVE POISSON SOLVER
O. Buneman May 1969 13 p refs
(Contract AT(04-3)-326)
(SUIPR-294) Avail: CFSTI

Subroutine XYPOIS converts a two-dimensional array of M by N charges Q into the corresponding array of potentials. It solves Poisson's equation in the finite-difference form. The same array is used for the final potentials as for the initial charges. Author (NSA)

N70-13334# Physics, Engineering, Chemistry Corp., Louisville, Colo.
INVESTIGATION OF THE DYNAMICS OF IONIZED MEDIA (PLASMAS), PARTS 1 AND 2
Wesley E. Brittin and Willard R. Chappell Wright-Patterson AFB, Ohio ARL Apr. 1969 76 p refs
(Contract AF 33(615)-2705)
(AD-692744; ARL-69-0068) Avail: CFSTI CSCL 20/9

A statistical mechanical theory of fields is developed. Since a field has an infinite number of degrees of freedom, it is natural and convenient to use functional methods for its description. The most general statistical mechanical state for a field is represented by a distribution functional which satifies a functional differential equation analogous to the Liouville equation. The functional Fourier transform characteristic functional is introduced and its properties are studied. Multitime functionals and various reduced distribution functions are also discussed. The formalism is applied to the free electromagnetic fields as well as to a system of charged particles (plasma) interacting via the electromagnetic field. Author (TAB)

N70-13357*# Maryland University, College Park. Inst. for Fluid Dynamics and Applied Mathematics.
LAMINAR SHOCKS AND OTHER NONLINEAR WAVES IN WARM PLASMAS
William F. Crevier (Ph.D. Thesis) Nov. 1969 136 p refs
(Grants NGL-21-002-005; NGL 21-002-033)
(NASA-CR-107211; TN-BN-626) Avail: CFSTI CSCL 20I

A two fluid model for collisionless shock waves in warm plasmas is presented. Dissipation is included by assuming an effective collision frequency. The model is capable of describing waves over a wide range of Mach numbers and angles of propagation. The wave behavior is compared to the motion of a particle moving in a somewhat complicated force field. A part of this force can be written as the gradient of a potential. By studying the shape of the potential for various initial conditions general conclusions about the wave behavior can be made. The potential well analogy is complicated by the fact that friction heats the plasma and alters the shape of the potential well. The response of the plasma to a small perturbation is analyzed by linearizing the equations of motion about their equilibrium values. Comparing the shape of the potential well near the origin with the results of the linearized equations of motion provides considerable physical insight into the initial wave behavior. Author

N70-13436# Atomic Energy Commission, Washington, D.C. Technical Information Div.
PLANAR PLASMA SOURCE [PLOSKOSTNOY ISTOCHNIK PLAZMY]
E. Ya. Golts et al Jul. 1969 18 p refs Transl. into ENGLISH from Russian report NP-17746
(AEC-tr-7057; NP-17746) Avail: CFSTI

Descriptions are given of a plasma source in which the discharge passed along an organic glass surface. The plasma jet formed in shorter time than the half-cycle of current in the source. The regularities of space - time distribution of the plasma jet density as a function of the intensity and magnitude of the source capacitance were investigated. The accelerated plasma clusters (of certain length and of high hydrogen purity) were obtained by

plasma jet cutoff by means of the planar source. In such a source the discharge takes place between two molybdenum electrodes along the organic glass plane. During measurements the negative electrode was grounded, the electric pulse initiating the discharge between electrodes was of negative polarity, and the vacuum was not below 0.000002 torr. NSA

N70-13445# Atomic Energy Commission, Washington, D.C.
THEORY OF LOW-FREQUENCY ELECTROMAGNETIC PROPERTIES OF A TURBULENT PLASMA
V. N. Tsytovich Jul. 1969 29 p Transl. into ENGLISH from Russian Preprint No. 172
(AEC-tr-7060) Avail: CFSTI

An approach is developed based on expansion of integrals for the collisions of plasma particles and turbulent pulsations with respect to the energy of turbulence. The dielectric constant of the plasma is found within the framework of this approach in the first approximation with respect to the energy of turbulence, and new types of low-frequency plasma oscillations are investigated. An approach is developed for computing the integrals of particle collisions and turbulent pulsations. An integral equation is derived for the kernels of the integrals of particle collisions with turbulent pulsations. The solution of this equation allows summation of the series with respect to turbulence energy in the given collision integrals. This integral equation is solved and the dielectric constant is found in the limiting case of Langmuir pulsations of large phase velocities. Author (NSA)

N70-13450# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
PLASMA ABSORPTION OF HIGH-FREQUENCY ENERGY NEAR THE LOWER HYBRID FREQUENCY [O POGLOSHCHENII PLAZMOY VCH ENERGII VBLIZI NPZHNEV GIBRIDNOY CHASTOTY]
B. V. Galaktionov et al [1968] 7 p refs Transl. into ENGLISH from Russian report FTI-136
(AEC-tr-7066; FTI-136) Avail: CFSTI

The experiments were performed in an open trap with a mirror configuration of the magnetic field. The plasma was created by shf power from the end of the device. The results obtained are as follows: independence of the maximum absorption frequency with respect to length of coil and angle of inclination of the exciting winding to the magnetic field and an increase in the maximum absorption frequency as the longtitudinal component of the density gradient increases. NSA

N70-13474*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THIRD-ORDER CONTRIBUTIONS TO ELECTRICAL CONDUCTION IN PLASMAS
Willard E. Meador Washington Dec. 1969 19 p refs
(NASA-TN-D-5477) Avail: CFSTI CSCL 20I

The electrical conductivity is calculated for a highly nonequilibrium plasma corresponding to the application of an electric field varying linearly with time. Two methods are employed: (1) The direct approach consisting of an exact solution to a modification of the third-order kinetic equation of Chapman and Enskog, and (2) Everett's technique for closing out the macroscopic equations of change with the Grad 13-moment velocity distribution function. Comparisons between the two sets of results indicate substantial third-order differences for most interparticle interaction potentials of practical interest; hence, the Grad 13-moment approximation does not appear to describe adequately certain higher order contributions to plasma transport coefficients. Author

N70-13480*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A VARIATIONAL PRINCIPLE FOR MAGNETOHYDRODYNAMIC CHANNEL FLOW
Norman C. Wenger Washington Dec. 1969 27 p refs
(NASA-TN-D-5591) Avail: CFSTI CSCL 20I

A variational formulation is presented for a class of magnetohydrodynamic (MHD) channel flow problems. This formulation yields solutions for the fluid velocity and the induced electric potential in a channel with a uniform transverse static magnetic field. The channel cross section is constant but arbitrary, and the channel walls can be either insulators or conductors with finite electrical conductivity. Electric currents are permitted to enter and leave the channel walls so that the solutions are suitable for MHD generator and pump applications. An example of a square channel with conducting walls is solved as an illustration. Author

N70-13496# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
USE OF STATIONARY MAGNETIC FIELDS ON ELECTRIC ARCS FOR IMPROVED EMISSION SPECTRUM ANALYSES [UEBER DIE VERBESSERUNG DES EMISSIONSPEKTRALANALYTISCHEN NACHWEISVERMOEGENS DURCH DIE ANWENDUNG STATIONAERER MAGNETFELDER AUG LICHTBOEGEN]
Diethard Lummerzheim Sep. 1969 117 p refs In GERMAN
(JUL-614-RW) Avail: CFSTI

The possibility of increasing emission spectroscopic analytic capacity by using longitudinal magnetic fields to delay the escape of analytical particles from the excitation field was studied on the direct current arc between two graphite electrodes. The resulting discharge rotation increased the temperature of the gas flow from cathode to anode and the correlations density between ionic and atomic lines of the investigated element vapors. Increased line intensities were attributed to almost complete capture of the vaporized substances in the magnetic arc, increased excitation through narrowing of the median free electron paths in axial direction, prolonged presence of analytical particles in the excitation field, and the change in plasma field temperature distribution through the induced rotation. Transl. by G.G.

N70-13502# Cornell Univ., Ithaca, N.Y. Plasma Studies Lab.
PROPERTIES OF THE HIGH BETA PLASMA STATE Progress Report, 15 Sep. 1968 - 31 Jul. 1969
31 Jul. 1969 103 p refs
(Contract AT(30-1)-3782)
(NYO-3782-3) Avail: CFSTI

Stability calculations are presented for shock-like disturbances propagating across collisionless high-beta plasmas. Turbulent plasma studies are described for the following areas: (1) turbulent heating processes, (2) nonlinear stabilization of hf instabilities in magnetic fields, (3) transport processes, (4) nonlinear beam-plasma interactions, and (5) nonlinear theory of ion-acoustic waves. A theoretical analysis of cyclotron resonance heating in magnetic traps is presented. In addition, the following three papers are included as appendices: (1) Finite Larmor Radius Effects in Plasmadynamics Magnetosonic Disturbance, (2) Finite Larmor Radius Effects in the Magnetosonic Pulse, and (3) Solitary Waves in a Magnetoplasma. NSA

N70-13514# Miami Univ., Coral Gables, Fla. Dept. of Physics.
CURVILINEAR POLYADIC MOMENTS OF THE BOLTZMANN EQUATION. PART 1: POLYADIC HIERARCHY FOR AN N-SPECIES, DILUTE, POINT PLASMA
Lawrence Carl Hawkins [1969] 34 p refs *Its* Plasma Phys. Bull. Vol. 9, No. 2
(Contract AT(40-1)-3895)
(ORO-3895-2) Avail: CFSTI

The Maxwell transport equation is rederived, using a general curvilinear polyadic moment of the Boltzmann equation. When this moment is specified in turn to be the velocity polyads, the coupled hierarchy of velocity moments for an N-species, dilute, point plasma is thereby obtained. For suitable choices of the moment and

proper polyadic contractions, all of the dilute, point plasma transport equations can be derived. Explicit results include: (1) The polyadic transport equation, with arbitrary acceleration, for the l-th order poly-pressure. (2) The first seven moment transport equations, for both arbitrary acceleration and electromagnetic acceleration, governing the flow of mass density, continuum velocity, energy density, heat flux vector, pressure tensor, heat flux tensor, and moment of momentum. Included also is an appendix summarizing the curvilinear polyadic calculus used. Author (NSA)

N70-13538# California Univ., Livermore. Lawrence Radiation Lab.
UNSTABLE PULSE PROPAGATION IN AN INHOMOGENEOUS PLASMA
L. S. Hall 4 Apr. 1969 6 p refs Presented at 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, 1–6 Sep. 1969 Submitted for publication
(UCRL-71644; CONF-690803-14) Avail: CFSTI

Numerical calculations were made for the Alfven wave firehose instability, the high-density cyclotron-resonant instability, and the high-density nonresonant electron-ion instability in the limit of $j \approx 1$ Dory–Guest–Harris loss-cone distribution. In the cases studied, the inhomogeneous system was found to be, respectively, more unstable, little different, and more stable than the homogeneous medium with the same parameters as at $x = 0$. Author (NSA)

N70-13559# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
INDUCED COMPTON EFFECT IN PLASMA AND ELECTROMAGNETIC WAVES UNDER ASTROPHYSICAL CONDITIONS
V. N. Tsytovich et al [1969] 31 p refs Transl. into ENGLISH from Russian report NP-17750
(AEC-tr-7051; NP-17750) Avail: CFSTI

It is shown that the induced effects resulted in amplification of high frequency electromagnetic waves when the distribution of relativistic electrons was anisotropic. At high density of relativistic electrons, the induced effects resulted in effective acceleration due to the simultaneous effects of electromagnetic and plasma waves. The acceleration effect grows proportionally to the square of particle energy and compensates losses related to the Compton effects. Under certain conditions, the self consistent distribution of relativistic electrons and electromagnetic emission produced a relativistic electron power spectrum with exponent gamma = 3. An equation was obtained for gamma and studies were made of gamma as a function of the magnetic energy H to 2nd power, in relation to the plasma energy density. Problems of high frequency radio emission from cosmic objects were analyzed and explanation given for the power character of their spectra. Problems related to emission spectra of quasars and new objects with strong radio emission are discussed. Author (NSA)

N70-13582# Institute for Advanced Study, Princeton, N.J.
STUDIES IN PLASMA PHYSICS Progress Report
Marshall N. Rosenbluth 29 May 1969 10 p refs
(NYO-3927-5) Avail: CFSTI

Brief discussions of research work are given for the following: (1) mirror-confined plasmas, (2) finite amplitude collisional drift waves, (3) effects of finite plasma pressure on microinstabilities, (4) other stability results, and (5) bananas, superbananas, etc. NSA

N70-13619# Texas Univ., Austin. Plasma Research Lab.
QUASISTATIC ION CYCLOTRON WAVE STUDIES Progress Report
D. G. Swanson 15 Aug. 1969 20 p refs
(Contract AT-(40-1)-3971)
(ORO-3871-1) Avail: CFSTI

At the present time, the experimental facility is virtually complete and in the testing stage. This has involved the complete redesign and construction of a new set of magnet coils for pulsed operation which allow adjustments in the field profile, and this phase has been completed and tested. In addition, it was determined a new form of ionization and preheater would be desirable, in the nature of a high-current axial discharge, and the redesign and construction has been completed and tested. Further studies of the plasma properties with the new ionizer are yet to be undertaken. The rf source and 80-kW pulsed oscillator-amplifier have been constructed and testing is presently underway. Although a few phases of the construction remain, such as a tuning box to match the transmitter into the launching antenna, it is anticipated that these things will be completed during the remainder of the contract year and studies of the wave properties in the high-density plasma can then be started. Author (NSA)

N70-13669# California Univ., Livermore. Lawrence Radiation Lab.
LASER LIGHT-SCATTERING MEASUREMENT OF PLASMA TEMPERATURE, DENSITY, AND CORRELATION SPECTRUM
Oscar A. Anderson 7 Jul. 1969 151 p refs
(UCRL-50699)

A physically oriented derivation of the differential cross section sigma(k,omega) for light scattered by a quasi-stationary non-Maxwellian plasma is presented. It is found that, with mild restrictions on the distribution functions F sub I and F sub e, the complicated result for sigma(k,omega) may be simplified. Correlation lengths are defined and used to divide the omega-spectrum into four ranges which in which simple approximations for sigma hold. A few constants depending on the shape of F sub I and F sub e then suffice to quantitatively describe all the important features of correlated scattering: ion-wave peaks, a nearby dip in the spectrum, a broad plateau, and plasma resonance peaks. The special case of deuterium plasma in thermal equilibrium is briefly treated. NSA

N70-13711# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
MACROSCOPIC EQUATIONS FOR THE ELECTRONS IN A PLASMA DOMINATED BY BINARY COLLISIONS [EQUATIONS MACROSCOPIQUES POUR LES ELECTRONS DANS UN PLASMA DOMINE PAR LES COLLISIONS BINAIRES]
Jacques Dorey 1969 5 p refs Presented at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, 1–6 Sep. 1969 Submitted for publication
(ONERA-TP-752) Avail: CFSTI

This paper develops equations describing the behavior of the electron density and temperature in an ionized gas created by thermal collisions between neutral particles. Author (ESRO)

N70-13712# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
PHOTODETACHMENT EFFECTS IN A RADIO FREQUENCY PLASMOID [EFFECTS DE PHOTO-DETACHMENT DANS UN PLASMOIDE A FREQUENCE RADIO]
Joseph Taillet, André Brunet, and Claude Pouit 1969 5 p refs Presented at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, 1–6 Sep. 1969 Submitted for publication
(ONERA-TP-751) Avail: CFSTI

By laser irradiation of a radiofrequency plasmoid, a sudden increase of electronic density is produced. This experiment gives direct evidence of the presence of large negative ion densities in radiofrequency plasmoids. Author (ESRO)

N70-13765# Oak Ridge National Lab., Tenn.
MULTIPLE PSEUDOWAVES PRODUCED BY A SINGLE VOLTAGE PULSE
I. Alexeff, W. D. Jones, and M. Widner 2 Jul. 1969 9 p refs

Submitted for publ. Sponsored by AEC Prepared in cooperation with Iowa Univ.
(PB-184726; ORNL-TM-2634) Avail: CFSTI CSCL 20I

A multiple pseudowave--or a series of fast ion bursts--is emitted when a short negative voltage pulse is placed on a transmitting grid. The phenomenon resembles, but is not, a damped wave train. Author (USGRDR)

N70-13797# Sandia Corp., Albuquerque, N.Mex.
IONIZING SHOCKS FROM HIGH EXPLOSIVES
M. Cowan May 1969 38 p refs
(PB-184916; SC-RR-69-328) Avail: CFSTI CSCL 19D

Techniques are described for generating ionizing shock waves with high explosive. Shock speeds high enough to completely dissociate and ionize hydrogen have been produced in relatively large diameter tubes. The high explosive used has a matrix of cylindrical cavities with their axes perpendicular to the detonation front which effectively doubles the escape velocity of detonation products from the explosive 'surface'. Author (USGRDR)

N70-13873# Academy of Sciences (USSR), Moscow. Inst. of Physics.
EQUILIBRIUM AND STABILITY OF PLASMA CURRENTS IN TOROIDAL SYSTEMS
S. E. Rosinskii and V. G. Rukhlin 1969 43 p refs In RUSSIAN *Its* Preprint No. 51
(NP-17973) Avail: AEC Depository Libraries

Studies were made of toroidal plasma current instabilities caused by trapped and slow emitting particles. Criteria were established for stabilizing various modes of oscillations induced by radial electric fields, longitudinal particle-current drifts, finite Larmor radii, finite drift orbits of trapped particles, and crossed lines of force in magnetic fields. It is shown that a certain channel-type instability in trapped particles can be stabilized by expansion in the case in which the magnitude of rotational transformation has the wave length maximum lambda sub 11 along the magnetic field lines of force shorter than the distance between the local mirrors in the magnetic field (L). Toroidal current systems and stellarator systems are compared and analyzed. Author (NSA)

N70-13931# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
FAST NEUTRON IRRADIATION EFFECTS ON DIFFUSION PROCESSES IN THE ALUMINIUM-MAGNESIUM SYSTEM [EFFETS DE L'IRRADIATION AUX NEUTRONS RAPIDES SUR LES PHENOMENES LIES A LA DIFFUSION DANS LE SYSTEME ALUMINIUM-MAGNESIUM]
Guy Moreau (Ph.D. Thesis--Paris Univ., 6 Jun. 1969) 1969 167 p refs In FRENCH; ENGLISH summary
(CEA-R-3906) Avail: CFSTI

Examination of bulky diffusion couples Al (Mg)--Al and Mg (Al)--Mg handled in the same thermal conditions (between 200 and 440 C) out of pile and under fast neutron irradiation show, in the latter case: 1) an increase of the growth kinetics of beta phase which can be explained with Kidson's formula; 2) an apparent increase of solubility caused by migration of a part of excess vacancies as complexes (vacancy-solute atom) to sinks (stacking faults, grain boundaries) or to sub-microscopical clusters; 3) an enhancement of chemical diffusion at low temperature. Interpretation can be carried out by Dienes and Damask's theory. Excess defects (vacancies and interstitials generated in equal numbers by radiation) annihilate by migration to sinks and by direct recombination. Sink density varies with temperature and irradiation time. The part of complexes (vacancy-solute atom) is important in the vacancies annealing kinetics. Author (ESRO)

N70-13938# Miami Univ., Coral Gables, Fla. Dept. of Physics.
AMBIPOLARITY AND PLASMA STABILITY
Harry S. Robertson [1969] 13 p refs Sponsored in part by AEC
(ORO-3895-1) Avail: CFSTI

The following statement is offered as a conjecture: The steady state of a bounded plasma is that state for which j · dA = 0 at every point of the boundary (except those that carry essential currents). A general theoretical argument in support of this conjecture (not a rigorous proof) is offered, based on the principle of minimum entropy production rate. Experimental evidence in support of the conjecture is cited. Author (NSA)

N70-13949# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
LAMINAR COLLISION FREE ELECTROSTATIC SHOCKS AND SHEATHS
Hans Persson Sep. 1969 66 p refs Revised version of Rept-69-05
(Rept-69-05-Rev) Avail: CFSTI

Special Bernstein-Greene-Kruskal solutions of the time-independent, one-dimensional, coupled Vlasov-Poisson equations are studied. The electrostatic potential is assumed to vary monotonically between two different, constant levels, and the ion and electron velocity distributions consistent with this potential are analysed. The charge neutrality, over-all pressure balance, and space charge, (internal pressure balance), conditions impose conditions of Mach number type on the collisionfree particle distributions. In particular, the Bohm criterion for wall sheaths is analysed, and is found to apply in all cases, when there are not sufficiently many particles of a given species reflected against the potential structure. This structure can be considered as the result of a balance between thermal-like particles, having a negative derivative of the density with respect to the potential energy, and beam-like particles, having a positive derivative. Earlier work by Montgomery and Joyce is discussed, and it is shown that under quite general conditions the Mach number must exceed unity, for small values of the potential. For arbitrary values of the potential, and for trapped electron distributions form a large class of functions the Bohm criterion implies that the Mach number of the ions behind the shock must exceed a critical value. Another, simplified shock model, with equal ion and electron temperatures, and ion reflexions against the structure is studied, as well as a couple of simple sheath models. At least in the simplified shock example chosen, laminar solutions exist only for a limited band of Mach numbers, in agreement with fluid shock results. The application of the theory to practical problems, its relationship to non-monotonic shocks, turbulent shocks, and fluid shocks is discussed, as well as some general questions concerning particle energy and potential differences in plasma. The space charge and Mach number conditions are analysed in an appendix. Author (ESRO)

N70-13957# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF ELECTRON CONCENTRATION BEHIND THE FRONT OF A SHOCK WAVE IN A GAS-DISCHARGE PLASMA IN A MAGNETOHYDRODYNAMIC SHOCKTUBE
V. A. Bashilov 20 May 1969 8 p refs Transl. into ENGLISH from Svoista Gazou Pri Vysokikh Temperaturakh Fiz. Gazodynam. Termodinam. i Fiz. Goreniya (Moscow), 1967 p 95-97
(AD-693836; FTD-HT-23-160-69) Avail: CFSTI CSCL 20/9

Determination of the electron density behind a shock wave was made using the Stark broadening of the H (subscript beta) line. The method of measurement is discussed, and instrumental, Doppler and pressure broadening effects analyzed. The exposed films were tagged by a 9-step wedge filter for accurate photometry of the H (subscript alpha) and H (subscript beta) lines. Using the characteristic curves, film exposure was related to the incident

intensity. The intensity was in turn related to the density of charged particles by use of the Holtsmark relations. The time-history of the density was obtained by using streak photography to observe the behavior of the H (subscript beta) line behind the shock front. For known shock velocities, the change in electron temperature was related by Sahas equation to the equilibrium temperature. The electron density and temperature so obtained are seen to agree with theoretical computations. The measurements of the electron density shows the existence of a smooth transition from the undisturbed gas to the discharge plasma. This is explained by the diffusion of electrons from the discharge region into the cold gas.
Author (TAB)

N70-13979# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
DETERMINATION OF PLASMA PARAMETERS PRODUCED BY SUPER HIGH-FREQUENCY POWER IN A MAGNETIC FIELD STEADY-STATE CONDITION
A. I. Anisimov et al [1969] 18 p refs Transl. into ENGLISH from Russian preprint no. 116
(AEC-tr-7052) Avail: CFSTI

A study was made of plasma produced by the super-high frequency power of a 3-cm wave range under conditions of electron cyclotron resonance. The studies were conducted in hydrogen at pressures 0.0005 to 0.01 mm mercury column and induced by a super-high-frequency power of an order of 200 watts. At the same time, the steady-state concentration of charged particles is found to be within the limits of 10 to the 11th power to 10 to the 13th power cm/cu and the temperature of the electrons is found to equal 1.5 to 15 eV. The experimental data are analyzed on the basis of balance equations.
Author (NSA)

N70-13984# Stanford Univ., Calif. Inst. for Plasma Research.
ELECTRON CYCLOTRON ECHOES FROM PLASMA
R. L. Bruce May 1969 151 p refs
(Contract AT(04-3)-326; Grant NSF GK-1711)
(SU-IPR-311) Avail: CFSTI

The response of a plasma column in a magnetic field to one, two, or three electromagnetic pulses under conditions where collective effects between the charged particles can be ignored, and a single-particle model is applicable is studied. The plasma response to a single pulse at the electron cyclotron frequency may be used as the basis of a diagnostic technique for obtaining collision data. The experimental method is described, and collision data obtained by this method are given for argon and neon. The effect of electron thermal motions on the accuracy of these results is considered, and the general limitations of the method are discussed. When the applied pulse frequency is far above the electron cyclotron frequency and plasma frequency, the plasma response may be used as a diagnostic for electron density. The method is described, and results are compared with data obtained by two other microwave techniques for electron density measurement.
NSA

N70-13994# Los Alamos Scientific Lab., N.Mex.
EQUILIBRIA OF COLLISIONLESS PLASMA, PART 2
Richard L. Morse 20 Aug. 1969 13 p refs
(Contract W-7405-eng-36)
(LA-3844-Pt-2) Avail: CFSTI

Vlasov equilibrium methods are applied to straight z pinches and multipoles and then to toroidal equilibria. The last section contains a conjecture about the role of the rigid drift equilibria in real plasma containment experiments.
Author (NSA)

N70-13997# Iowa State Univ. of Science and Technology, Ames.
APPLICATIONS OF THE INDUCTION COUPLED PLASMA TO ANALYTICAL SPECTROSCOPY
George Wilson Dickinson (Ph.D. Thesis) Aug. 1969 118 p refs
(Contract W-7405-eng-92)
(IS-T-309) Avail: CFSTI

Calibration curves for Ce, Nb, Ti, and V in Fe are presented. The feasibility of directly and continuously determining the composition of molten metal was experimentally demonstrated. Ultrasonic energy is employed to form finely divided droplets directly from the molten metal. On solidification these droplets form a metallic dust, which is transferred continuously into the high temperature environment of an induction-coupled plasma. The plasma vaporizes the dust and excites the atomic spectra of the constituents in the metal sample. The emitted optical spectra are observed with a recording spectrometer and calibration curves for As and Cu in Sn – Pb solder are presented. These experiments have so far been limited to low-melting alloys of bismuth, lead, and tin. Samples of powdered materials were introduced into the induction-coupled plasma. Devices employed to supply a flow of powder to the plasma are shown and observations made are discussed.
Author (NSA)

N70-14018# California Univ., Berkeley. Lawrence Radiation Lab.
STABILITY OF AN ELECTRON-ION RING
A. G. Bonch-Osmolovskii et al Feb. 1969 22 p refs Transl. into ENGLISH of the Book 'Vopr. Ustoychivosti Elektron-Ionnogo Koltsa' Dubna, USSR, JINR, Nov. 1968 p 1–9 In RUSSIAN and ENGLISH Sponsored by AEC
(UCRL-TRANS-1392; JINR-P9-4138) Avail: CFSTI

Basic questions connected with the stability of an electron-ion ring in an external magnetic field are discussed. Instabilities characteristic both for electron beams in magnetic fields (high-current accelerators) and electron-ion systems (plasmas) are studied.
NSA

N70-14045# California Univ., Livermore. Lawrence Radiation Lab.
MEASUREMENT OF ENERGY DEPOSITION IN LASER-PRODUCED PLASMAS
G. I. Kachen and J. O. Kysilka 14 Jul. 1969 6 p ref
(UCRL-50708) Avail: CFSTI

Measurement of the energy absorbed in a laser-produced plasma is determined by two methods: (1) photodiode measurements of the intensity differential in the beam before and after breakdown and (2) pressure-transducer readings of the adiabatic pressure rise in the plasma enclosure. When corrections are made for the non-adiabatic losses, the two measuring techniques give equivalent results within experimental accuracy.
Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-12781# Brookhaven National Lab., Upton, N.Y.
INVESTIGATION OF A SUPERCONDUCTING NIOBIUM CAVITY AT S-BAND
H. Hahn and H. J. Halama 1969 10 p refs Presented at the 7th Intern. Conf. on High Energy Accelerators, Moscow, 27 Aug.–2 Sep. 1969 Sponsored by AEC
(BNL-13835) Avail: CFSTI

The unloaded quality factor was measured at low levels by the frequency-sweep technique, and power measurements were performed in the TE sub 111 and TM sub 011 modes at high levels. Low-level surface resistance of superconducting niobium at 4.2 K in the 2 to 4 GHz frequency range, variation of the low-level residual resistance with time, nonlinear resonant curves of TE sub 111 and TM sub 011 modes for slow fm signal, and the dependence of the surface resistance on the peak value of the rf magnetic field are presented graphically.
NSA

N70-12822# Bureau of Mines, Minneapolis, Minn.
AN ULTRASONIC METHOD FOR DETERMINING THE ELASTIC SYMMETRY OF MATERIALS
Thomas R. Bur, Richard E. Thill, and Kenneth E. Hjelmstad Dec. 1969 27 p refs
(BM-RI-7333) Avail: Issuing Activity

Symmetry theory, based on ground work established in the study of single crystals and experimental procedures utilizing ultrasonic pulse velocities of spherical specimens plotted on equal area polar projections, enables the direct identification of a material's elastic symmetry system and the determination of its orientation, as well as the position of the elastic coordinate axes. The method is especially useful for elasticity studies of polycrystalline and amorphous materials for which this knowledge of symmetry is a prerequisite in determining the independent elastic constants. Projections based on theoretically derived velocities are given for a single crystal from each of the major crystallographic symmetry systems except the triclinic. Projections based on experimentally derived velocities are given for one brass and several rock spheres.
Author

N70-12823# Bureau of Mines, Minneapolis, Minn.
SUGGESTED ORIENTATION CONVENTIONS FOR ELASTICALLY ANISOTROPIC POLYCRYSTALLINE AND AMORPHOUS MATERIALS
Thomas R. Bur Dec. 1969 12 p refs
(BM-RI-7334) Avail: Issuing Activity

The order of identification and in some cases the magnitude of elastic constants of an anisotropic material depends on the orientation of the cartesian coordinate axes with respect to a set of reference coordinate axes within the material; thus confusion will result unless standard orientations are used. In this paper the relationship between the cause (the internal fabric) and the effect (the elastic properties in this case) is discussed for single crystals and for polycrystalline and amorphous materials. While reference axes based on the cause are used in the Institute of Radio Engineers standard for piezoelectric crystals, it is shown that a reference coordinate system that would be suitable and practical for all anisotropic polycrystalline and amorphous materials must be based directly on a three dimensional expression of the effect. The conventions offered are similar to the IRE standards for piezoelectric crystals, but use the elastic coordinates of the wave surface which can be readily established experimentally as the reference coordinates.
Author

N70-12837# Sandia Corp., Albuquerque, N.Mex. Technical Translation Service.
THE SUPRACONDUCTION OF GERMANIUM AND SILICON UNDER HIGH PRESSURE [ZUR SUPRALEITUNG VON GERMANIUM UND SILIZIUM UNTER HOHEM DRUCK]
J. Wittig 18 Sep. 1969 9 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 195, 1966 p 217-222
(PB-186096T; SC-T-69-1043) Avail: CFSTI CSCL 20L

The excerpt describes the pressure cell used in the study.
USGRDR

N70-12922*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORY OF GALVANOMAGNETIC EFFECTS IN METALS
Gale Fair Washington Dec. 1969 62 p refs
(NASA-TN-D-5588; E-5087) Avail: CFSTI CSCL 11F

A solution to the linearized Boltzmann equation has been found that describes the galvanomagnetic properties of metals. The use of a vector mean-free-path function results in a solution for the conductivity tensor that is valid for any strength and orientation of the applied magnetic field. A discussion is given of the implementation of this theory to give a quantitative description of the galvanomagnetic properties of a metal with a specified Fermi surface and with a model for the scattering of the conduction electrons. Finally, two scattering models are treated for a metal having a spherical Fermi surface. The familiar result for a free-electron gas is derived, and the case of a degenerate scattering kernal is treated in detail.
Author

N70-13071 European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
A SUPERCONDUCTING SOLENOID COOLED BY FORCED CIRCULATION OF SUPERCRITICAL HELIUM
M. Morpurgo 22 Sep. 1969 14 p refs
(CERN-69-25) Copyright. Avail: Issuing Activity

Descriptions are presented of the coil which weighs approximately 600 kg and produces a field of 50 kG in a bore of 28 cm. Details are given on the cooling circuit and the helium circulation. The coil was cooled from room temperature to operating temperature in approximately 24 hours. The following conditions were measured at the end of the cooling: helium pressure at the coil input, 6 atm, and at the coil output, 5 atm; helium temperature at the coil input, 4.5 K, and at the output, 5 K. Helium flow through the coil was calculated to be 12g/sec. The current was raised from zero to 1400 A in 6000 sec and the coil quenched slightly above that current. The coil was found to quench at the same current in successive operations.
N.E.N.

N70-13102# Oak Ridge National Lab., Tenn. Office of Language Services.
GROWTH OF THE DIMENSIONS OF THE CRYSTALLINE REGIONS DURING THE GRAPHITIZATION OF CARBON
J. Maire (Soc. Le Carbone-Lorraine) and J. Mering (Inst. Natl. Rech. Chim. Appl.) [1969] 9 p refs Transl. into ENGLISH from 4th Carbon Conf. Proc. (Paris), 1959 p 345-350
(PB-186211T; ORNL-tr-2217) Avail: CFSTI CSCL 20B

The communication concerns the variation of the dimensions of the particles during the graphitization of soft carbon. The results reported are part of a combined work on the process of graphitization. It was shown that the process of graphitization operates in two stages. In the first stage the mean thickness of the particles increases considerably. In the second stage the apparent diameter begins.
Author (USGRDR)

N70-13172# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
MECHANISM FOR THE ENVIRONMENTAL CONTROL OF DRILLING IN MgO AND CaF SUB 2 MONOCRYSTALS
A. R. C. Westwood and D. L. Goldheim Aug. 1969 35 p refs
(Contract Nonr-4162(00))
(AD-693439; RIAS-TR-69-10C; TR-13) Avail: CFSTI CSCL 20/2

The effects of certain liquid environments on the penetration of a carbide space drill, and on the mobility of near-surface edge dislocations in freshly cleaved MgO and CaF2 monocrystals, have been determined at room temperature. It was found that drilling efficiency and near-surface dislocation mobility are directly related, and that softening environments facilitate crack initiation in MgO. The n-alkanes have also been found to be extremely surface active with respect to MgO and CaF2 surfaces. It is proposed that adsorbed surface-active species control the drilling behavior of MgO and CaF2 -- and perhaps of other notch-sensitive nonmetallic solids (minerals) also -- as a consequence of their influence on the flow and flow-dependent fracture properties of the near-surface regions of these solids. Possible effects of adsorption-induced reductions in surface free energy are of minor importance.
Author (TAB)

N70-13278# Pennsylvania State Univ., University Park. Dept. of Physics.
INFRARED EMISSION FROM FREE CARRIERS IN GERMANIUM

Edward A. Ulmer, Jr. Dec. 1968 99 p refs
(Contract Nonr-656(34))
(AD-678315; TR-6) Avail: CFSTI CSCL 20/12

Conley observed a radiation near 5 microns upon injecting excess carriers into thin germanium samples. The present investigation sought to identify the source of this radiation, and to study its properties. Preliminary measurements showed that the radiation was originating in the bulk and not at the surface of the samples. The emission intensity was found to increase with sample temperature which indicated that phonons were involved in the emission mechanism. This led to a study of free carriers since it was known that free electron absorption in germanium was a phonon-aided process. Author (TAB)

N70-13420# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
ANISOTROPY OF THE SUPERCONDUCTING ENERGY GAP IN THORIUM
Joseph William Anderson (M.S. Thesis) Nov. 1968 52 p refs
(Contract W-7405-eng-82)
(IS-T-282) Avail: CFSTI

It was found that pure thorium has a mean-squared anisotropy in the energy gap of 0.021 and that it takes impurity scattering equivalent to a change in residual resistivity of approximately 6.0 microohm-cm to wash out this anisotropy. For a host material with $<a \text{ sub } 2> = 0.021$ one would expect the change in T sub c due to anisotropy to be less than 0.03 K. This is only 4% of the total depression of T sub c for the samples so it appears that magnetic scattering factors dominate. The same situation applies for the critical field measurements. The maximum change in the deviation function which could come from complete washing out of the anisotropy would be 0.007 and one would expect the samples to show somewhat less change because anisotropy effects are only partially eliminated. Author (NSA)

N70-13611# Florida Univ., Gainsville. Coll. of Engineering.
A CENTER OF COMPETENCE IN SOLID STATE MATERIALS AND DEVICES Scientific Report
Fred A. Lindholm, Arthur J. Brodersen, Eugene R. Chenette, Robert W. Gould et al 10 Oct. 1968 229 p refs
(Contract F19628-68-C-0058)
(AD-678170; AFCRL-68-0493; SR-2) Avail: CFSTI CSCL 20/12

The content of this report, for the second semi-annual period of contract support, comprises three main topics. The first treats of the relationships borne in glasses between microstructure and electrical properties. The second main topic deals with the measurement of parameters of material structure, demonstrating the measurement techniques by applying them to various materials: glass ceramics, nickel alloys, magnetic films, and degenerate semiconductors. The third main topic concerns semiconductors and semiconductor devices. One study reports, for degenerate n-type germanium and silicon, the theoretical variation of the density of quantum states as a function of impurity concentration. Author (TAB)

N70-13680# Washington State Univ., Pullman. Dept. of Solid State Physics.
SPECTROSCOPIC STUDIES OF ACTINIDE IONS IN CRYSTALLINE SOLIDS Progress Report, 1 Oct. 1968 - 30 Sep. 1969
John B. Gruber 30 Sep. 1969 203 p refs
(Contract AT(45-1)-2012)
(RLO-2012-3) Avail: CFSTI

Developments are reported for studies on: absorption spectra of Np(4+) in single-crystal ThO2; far IR studies of Np hexchloro compounds; ESR of Np(4+) in ThO2; NMR and NQR of actinide ions in single-crystal insulators; crystal spectrum of rare earth hexa-halide complexes; double-photon excitation of rare earth and actinide ions in crystalline solids; electric conductivity of polar semiconductors via the Kubo formalism; absorption spectra of Tm(3+) in TmCl3 plus 6H2O and 2% Tm(3+) in YcI3 plus 6H2O; absorption spectra of Tm2(SO4)3 plus 8H2O; construction of high temperature furnace and single-crystal growth preparation; and programs developed for solid-state physics. Two articles on double-photon excitation of rare earth and actinide ions in crystalline solids and galvanomagnetic properties of semiconductors are appended. NSA

N70-13773# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
DETERMINATION OF THE CRYSTAL SYSTEM AND LATTICE PARAMETERS OF PREVIOUSLY UNREPORTED COMPOUNDS
C. E. Holcombe 22 Sep. 1969 24 p
(Contract W-7405-eng-26)
(Y-1687) Avail: CFSTI

Computer programs were developed in BASIC language, for the CEIR 420 teletype computer system, in order to index patterns of cubic, tetragonal, and hexagonal materials whose crystal systems were previously unidentified by analytical methods. Author (NSA)

N70-13781# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ULTRAVIOLET MAGNETO-OPTICS OF OPAQUE MAGNETIC MEDIA: FERRIC OXIDE COMPOUNDS
Frederic J. Kahn May 1969 208 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008)
(AD-694472; TR-588) Avail: CFSTI CSCL 20/12

The first observations of uv optical and magneto-optical spectra for bulk, single-crystal ferric oxide compounds are reported. Measurements were made on rare earth orthoferrites, rare earth iron garnets, nickel ferrite, and ferrimagnetic magneto-plumbite. In particular these results include the first uv measurements of the complex polar Kerr effect for any material. The magneto-optical measurement technique (complex polar Kerr effect) is discussed, the experimental hardware is described, and the data is analyzed in terms of a molecular orbital theory which elaborates on earlier theories by Clogston. Author (TAB)

N70-13871# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultat.
ON THE THEORY OF NUCLEAR SPIN RELAXATION IN SUPERCONDUCTORS OF SECOND TYPE [ZUR THEORIE DER KERNSPINRELAXATION IN SUPRALEITERN ZWEITER ART]
Werner Pesch (Ph.D. Thesis) 1968 107 p refs In GERMAN
Avail: CFSTI

Nuclear spin relaxation time is treated theoretically and experimentally in type 2 superconductors, particularly niobium and vanadium, in the vortex state near the upper critical field strength. Solutions of the Gorkov equations are presented, taking account of the free length of path of the electrons, which are then evaluated numerically. The methods are applicable also to other phenomena, e.g. the absorption of ultrasonic waves in superconductors. ESRO

N70-13926# Sandia Corp., Albuquerque, N.Mex.
RADIATION EVALUATION OF THE EBERS-MOLL AND CHARGE CONTROL MODEL PARAMETERS OF SEVEN TRANSISTOR CODES
W. H. Sullivan, A. R. Phillips, and L. K. Horning Jun. 1968 151 p refs
(SC-RR-68-225) Avail: CFSTI

This report describes the neutron-induced changes in the large-signal model parameters for seven transistor codes. In this investigation, relatively small samples of the G657046, G657071, G657133, G657137, G657155, G657318, and G657322 device codes were evaluated. Data are presented which define each large-signal model parameter prior to irradiation at fluence levels of

1.9 × 10 to the 13th power, and 1.0 × 10 to the 14th power NVT, E > 0.01 MeV. Also, formulas for converting the measured parameters to the Ebers-Moll model parameters and to the charge control parameters (as used in the CIRCUS circuit analysis computer program) are presented. Author (NSA)

N70-14009# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

CONFIGURATION AND MIGRATION OF POINT DEFECTS IN ALKALI METALS [CONFIGURATION ET DEPLACEMENT DE DEFAUTS PONCTUELS DANS LES METAUX ALCALINS]

Ian M. Torrens and Maurice Gerl Oct. 1969 26 p refs In FRENCH; ENGLISH summary
(CEA-R-3849) Avail: CFSTI

A computer calculation of vacancy and interstitial migration using a pair interaction potential deduced from the theory of pseudo-potentials is described. The parameters involved in the expression of the potential are adjusted so as to reproduce the elastic constants and the phonon spectrum of the perfect crystal. One obtains the relaxation energies at equilibrium configuration and at the saddle point and the migration energy of a vacancy and an interstitial in the alkali metals. For Na, K and Rb the vacancy mechanism is the most probable whereas in Li, there is a possibility of an interstitial mechanism, which would explain the experimental results. The diffusion of alkali solutes in alkali metals is analysed by means of a pair interaction potential deduced from the physical properties of the pure solvent and solute crystals. For solute atoms bigger than the solvent, the substitutional mechanism explains the experimental results whereas an interstitial mechanism is more probable for small impurities. This phenomenon may explain the experimental results observed for the diffusion of Na in K and K in Na. The Delta Q values are given for several combinations of the four alkali metals Li, Na, K and Rb. Author (ESRO)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

No abstracts in this issue.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-12865*# General Electric Co., Cincinnati, Ohio.

LF336A HIGH PRESSURE RATIO LIFT FANS Final Report

L. J. Volk 1 Apr. 1969 67 p
(Contract NAS2-4130)
(NASA-CR-73387; R69AEG180) Avail: CFSTI CSCL 21E

Two 36 inch diameter, 1.3 pressure ratio lift fans were built for use in wind tunnel tests of large-scale aircraft models. This report briefly describes the fan design & summarizes the static test program. The fan is a single stage, turbotip, rotor-stator design. The primary power source is a non-afterburning J85-5 turbojet engine. The fan, however, is also capable of operation with the J97 engine. Fan pressure ratio is 1.3 and the fan diameter is 36 inches. Scroll nozzle area is adjustable to accomodate engine variations and installations with other than design duct pressure losses. Major scroll area adjustments can be made to accomodate the J97 engine. The fan is primarily designed to be wing mounted, however provisions are made for lift pod mounting. Static parts are of non-flight-weight, low-stress design, to lower the design and manufacturing cost and to provide configuration flexibility. The fan and turbine stators can be removed in sectors of 24 degrees, and the front frame can be modified to support inlet guide vanes. Author

N70-12963# McGill Univ., Montreal (Quebec). Mechanical Engineering Research Labs.

HYPERSONIC PROPULSION LABORATORY Annual Progress Report, Nov. 1968 – Oct. 1969

Oct. 1969 58 p refs
(Contract APL-271798; Grants DRB-9550-06; NRC A-4190; NRC A-5158; NRC A-5167; NRC A-5189)
(Memo-69-4) Avail: CFSTI

This Progress Report describes the work conducted by the Hypersonic Propulsion Laboratory. In all, 21 projects were studied during the year. These projects concern basic aerodynamics as related to hypersonic air-breathing propulsion with application to air inlets, combustion chambers, exhaust nozzles and vehicle flight tests of scramjet engines. Author

N70-13036# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.

PROJECT SQUID Semiannual Progress Report, 1 Apr. – 30 Sep. 1968

J. B. Anderson, S. H. Bauer, C. E. Bond, J. A. Fay, and J. B. Fenn 1 Oct. 1968 74 p refs
(Contract N00014-67-A-0226; Proj. SQUID)
(AD-677936) Avail: CFSTI CSCL 21E

Reports of progress during the past six months on 14 of the 15 research programs composing Project SQUID are presented. The research programs fall into the areas of fluid mechanics and MHD. Atomic and molecular collisions, combustion and chemical rate processes, and chemi-ionization and ion-molecular reactions. Project SQUID is a cooperative program of basic research related to jet propulsion. Author (USGRDR)

N70-13418*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LUNAR EXCURSION MODULE RCS ENGINE VACUUM CHAMBER CONTAMINATION STUDY

Gary M. Arnett 8 Jul. 1969 184 p refs
(NASA-TM-X-53859) Avail: CFSTI CSCL 21E

The objective of this study was the definition of future contamination studies and procedures, and the investigation extended to the effects of the Reaction Control System (RCS) plume on optical flight experiments. This report is concerned with the effects of the RCS plume deposits on the test beds along with the characteristic changes that occur once these deposits are exposed to the laboratory atmosphere. Test beds consisting of various optical surfaces were exposed to an LM-RCS rocket engine plume in the vacuum chamber. Analysis of the contaminated test beds included optical measurements ranging from the near-ultraviolet through the far-infrared region together with mass spectrometer identification of the deposits. This study demonstrates that the instrumental procedures and sample handling are insufficient in many ways; however, the experience gained has led to an improvement of laboratory techniques and has greatly facilitated the interpretation of the results. In some cases, more suitable apparatus has been utilized that will enhance data analysis from planned orbital flight contamination experiments. Author

N70-13430*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.

INVESTIGATION OF METHODS FOR TRANSPIRATION COOLING LIQUID ROCKET CHAMBERS Final Report

15 Dec. 1969 324 p refs
(Contract NAS8-21135)
(NASA-CR-107268; PWA-FR-3390) Avail: CFSTI CSCL 21E

Results of a literature search and vendor survey to determine existing transpiration-cooling methods and available porous media for application in transpiration-cooled rocket chambers are presented

herein. Five porous matrix types were analytically investigated for rocket chamber application with hydrogen, methane, nitrogen tetroxide, and 50% N2H4 – 50% UDMH used as coolants. The required coolant mass flux and resulting performance index for each matrix type are presented as functions of wall temperature. Results include the effect of coolant phase change and/or chemical decomposition when applicable. A broad range of operating conditions was considered, representing throat heat flux conditions for chamber pressures of 50 to 3000 psia. A recommended procedure, illustrated by a sample calculation, is presented for the preliminary selection of a porous material for chamber application. Two transpiration-cooled nozzles were demonstrated. The first nozzle, unique in design, used a woven and sintered wire matrix and was cooled with gaseous hydrogen. The second nozzle was cooled with liquid N2O4 and was used to study vaporization of the coolant within the permeable wall. Author

N70-13470*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A 48-MODULE SWIRL-CAN TURBOJET COMBUSTOR SEGMENT AT HIGH TEMPERATURES USING ASTM-A1 FUEL
Richard W. Niedzwiecki and Harry M. Moyer Washington Dec. 1969 39 p refs
(NASA-TN-D-5597) Avail: CFSTI CSCL 21E

A turbojet combustor consisting of an array of swirl-can modules was evaluated in a rectangular duct at temperature levels encountered in advanced engines. Performance was evaluated at inlet air temperatures of 600 and 1150 F (589 and 894 K), a pressure of 3 atm, and reference velocities up to 180 ft/sec (54.9 m/sec). Combustion efficiencies were 100 percent at combustor exit temperatures near 2200 F (1477 K). Overall pressure loss was 6 percent at a diffuser inlet Mach number of 0.25 and an exit-to inlet-temperature ratio of 2.5. The exit temperature pattern factor varied from 0.19 to 0.24, decreasing with increasing inlet temperature. Altitude blowout and relight tests were conducted at a combustor reference Mach number of 0.1, a fuel-air ratio of 0.015, and inlet air temperatures and pressures of 100 to 700 F (311 to 644 K) and 0.5 to 3.0 atm, respectively. Author

N70-13477*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN AUTOMATIC RESTART CONTROL SYSTEM FOR AN AXISYMMETRIC MIXED-COMPRESSION INLET
Gary L. Cole, George H. Neiner, and Michael J. Crosby Washington Dec. 1969 39 p refs
(NASA-TN-D-5590) Avail: CFSTI CSCL 21E

An automatic restart control system is described which, unlike conventional inlet controls, retains closed-loop control of terminal shock position throughout a restart cycle. Closed-loop terminal shock control is retained so that near maximum diffuser-exit pressure recovery and minimum distortion levels can be achieved. The restart control system was tested with the inlet coupled alternately to a cold pipe having a choked-exit plug and a J85-13 turbojet engine. Tests were conducted in the Lewis 10- by 10-Foot Supersonic Wind Tunnel at free-stream Mach numbers of 2.50, 2.30, and 2.02. The inlet was unstarted by a downstream disturbance and, in all cases, the inlet was successfully restarted. Author

N70-13623 United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
TURBINE ENGINE DYNAMIC COMPATIBILITY WITH HELICOPTER AIRFRAMES
Kenneth C. Mard and Paul W. von Hardenberg *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 17-30 refs (See N70-13621 03-32)
Copyright. Avail: Issuing Activity

An intensive investigation into the dynamic characteristics of the CH53A/T64-6 engine installation was performed. The purpose was to gain assurance that the turbine engine and helicopter airframe dynamic characteristics were compatible and that unanticipated dynamic problems would not occur during service life. This program included an analysis of engine and airframe induced vibration characteristics, ground shake tests with and without the engine operating, and flight test verification of the installation. Data gathered on natural modes, forced response and the procedures developed in evaluating the effects of interface impedance provided a high degree of confidence that future changes to the airframe or engine would not result in unanticipated problems. Author

N70-13809# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GREAT SIGNIFICANCE FOR ROCKET DYNAMICS OF SOVIET SUCCESS IN LAUNCHING SPACESHIP
Te-wei Lo 26 May 1969 6 p Transl. into ENGLISH from Hang K'ung Chih Shih (China), No. 6, 1960 4 p
(AD-693837; FTD-HT-23-890-68) Avail: CFSTI CSCL 21/8

The paper cites, in a popularized fashion, a series of technical problems in the design of a rocket engine. High energy chemical fuels such as liquid oxygen and liquid hydrogen or liquid oxygen and liquid fluorine should be used to raise the unit thrust to 380-400 kg-sec/kg. (Large thrust rockets are possible if a multi-stage rocket is used; a stage consists of several bundles of rockets and each bundle consists of several combustion chambers). Pulsating combustion is a very complicated problem to solve.
Author (TAB)

N70-13850*# Electro-Optical Systems, Inc., Pasadena, Calif.
ION MICROTHRUSTER SYSTEM INVESTIGATION Final Report, 15 Oct. 1968 – 15 May 1969
15 May 1969 74 p refs
(Contract NAS5-11646)
(NASA-CR-107367) Avail: CFSTI CSCL 21C

Problems encountered in developing and testing contact ion microthruster systems for flight on Applications Technology Satellites D and E are discussed. Investigations were made of thruster performance degradation due to contamination of the ionizing surface. Selected circuit modifications were made and tested in the control logic and power conditioning unit of the contact ion microthruster systems. The transient response of the beam control feedback loop was investigated. Although no definite cause can be identified, ionizer contamination appears to be related to contamination of vacuum changer surfaces exposed to the thruster. Contamination by the control logic and power conditioning package appears unlikely. Circuit modifications that were made and tested resulted in an improved system. Investigation of feedback loop transient response improved the understanding of system behavior.
Author

N70-13851*# Aerotherm Corp., Palo Alto, Calif.
A STUDY OF THE BOUNDARY FLOW IN A ROCKET COMBUSTION CHAMBER. PART 2: DATA ANALYSIS, CORRELATION, AND THEORETICAL PREDICTION Final Report
R. D. Grose, M. R. Wool, and C. J. Deblaye 22 Sep. 1969 161 p refs Prepared for JPL
(Contract NAS7-463; Aerotherm Proj. 7009)
(NASA-CR-107309; FR-69-51-Pt-2) Avail: CFSTI CSCL 21H

Data obtained from a rocket combustion chamber buring nitrogen tetroxide and hydrazine at a nominal mixture ratio of 1.3 and at a nominal chamber pressure of 150 psi are analyzed. The details of the injector design and construction are presented. Most of the analyses were performed using operational computer codes as computational tools. These codes represent a high degree of sophistication in the treatment of both the boundary flow and chemical events which occur in the boundary flow. Descriptions of the way in which these computational tools were used, the preparation of input, the assumptions implicit in the input and computations, and the interpretation of the results from the computer codes are given. Author

N70-13858# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF ERRORS IN FLOW PASSAGE MANUFACTURE ON THE DIVERGENCE OF RATED CHARACTERISTICS OF TURBOJET ENGINES (TRD)
A. S. Tikhonov et al 14 May 1969 14 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan) (AD-694386; FTD-MT-24-421-68) Avail: CFSTI CSCL 21/5

A method is presented for determining the deviations of the coefficient of losses introduced during the process of manufacturing turbojet engine flow passages. Although the loss coefficient depends on many factors, the probability for obtaining identical dimensions in most engines depends on a certain law. This law was determined from engine statistical data. The deviation of the loss coefficients was determined from a given formula. An analysis of the statistical data of single- and double-shaft turbojet engines showed that at the existing deviations in the loss coefficients, one of the performance characteristics will deviate from the specified tolerances in 30-35 percent of the engines. Such deviations are caused by various manufacturing errors introduced into the flow passages. The proposed method can be used in the design of aircraft engines for determining the percentage of engine components having deviations. Author (TAB)

N70-13882# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
AN ELECTRIC PROPULSION SYSTEM TO REACH A GEOSTATIONARY ORBIT [UN SISTEMA A PROPULSIONE ELETTRICA PER LA REALIZZAZIONE DI ORBITE GEOSTAZIONARIE]
Carlo Buongiorno Sep. 1968 25 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziali No. 19
Avail: CFSTI

A feasibility study is presented of a solar cell powered ion thrustor to be used in the transfer of a Scout-launched application satellite into geostationary orbit. The specific impulse, the acceleration, the efficiency of the thrustor, and its design and dimensions are discussed, as well as problems connected with the solar cell power supply. Author (ESRO)

N70-13885*# Aerotherm Corp., Palo Alto, Calif.
A STUDY OF THE BOUNDARY FLOW IN A ROCKET COMBUSTION CHAMBER. PART 4: DEVELOPMENT OF EXPERIMENTAL HARDWARE AND TECHNIQUE Final Report
Ronald D. Grose 22 Sep. 1969 210 p refs Prepared for JPL (Contract NAS7-463)
(NASA-CR-107319; FR-69-51) Avail: CFSTI CSCL 21H

A sampling system using a hard seat valve, a heat flux gage, and other components was developed for boundary flow composition research in a rocket motor combustion chamber. The preliminary rocket motor was fired 16 times for a shake-down of the test facility and to acquire preliminary sample data and tune the pressurization/flow control system. Techniques for the chemical analysis of the samples are described. A FORTRAN 4 computer code was written for reduction of the sampling system data. Equations are given for determining mass velocity in the laminar sublayer and in the sintered element, and for formulating oxidizer to fuel ratios. J.A.M.

N70-13891# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF AN INDEPENDENT COOLING SYSTEM FOR A GAS TURBINE
E. A. Manushin et al 22 May 1969 13 p refs Transl. into ENGLISH from Izv. Vyssh. Zaved. Mashinostro. (Moscow), no. 12, 1967 p 135-140
(AD-693852; FTD-MT-24-114-69) Avail: CFSTI CSCL 21/5

The necessity for experimental study on an autonomous cooling system for gas turbine rotor blades is examined. The design and technological peculiarities of a test facility for investigating a high-temperature turbine with an independent cooling system are described, and investigation problems are presented. Author (TAB)

N70-13927# Politecnico di Torino (Italy). Centro Studi Motorizzazione Agricola.
POSSIBILITIES AND PROBLEMS OF GAS TURBINE APPLICATION FOR GROUND MOTION MACHINES [POSSIBILITA E PROBLEMI DELL'APPLICAZIONE DELLE TURBINE A GAS ALLE MACCHINE PER MOVIMENTO TERRA]
Gianni Rigamonti and Fiorenzo Morra (Fiat) Assoc. Tec. Automobile Jun. 1969 19 p refs In ITALIAN Sponsored by Consiglio Nazl. delle Ric. *Its* Ric. ATA, Quaderno 69, Suppl. to No. 6
(Publ-18) Avail: CFSTI

The present state of development of gas turbine engines for surface propulsion through a mechanical transmission is outlined. The space/power and weight/power relationship and the operational characteristics are discussed, as well as the utilization of the prime mover as a power supply to the auxiliaries. For gas turbine drives special systems of motor braking must be devised and new problems are encountered in installation, noise level, air filtering and exhausts. ESRO

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-12934*# Boeing Co., Seattle, Wash. Aerospace Group.
EXPERIMENTAL STUDY OF EFFECTS OF SIMULATED NEUTRALIZED SOLAR WIND ON WHITE-PIGMENT THERMAL CONTROL COATINGS
Lawrence B. Fogdall, Sheridan S. Cannaday, Fredrick D. Reinke, and Barbara K. Madaras Oct. 1969 59 p refs
(Contract NAS2-5343)
(NASA-CR-73389) Avail: CFSTI

An experimental program to obtain information about the neutralization properties of the simulated solar wind has been conducted. Selected thermal control coatings were exposed to the simulated solar wind and solar electromagnetic radiation environment. Duplicate exposures except for the presence or absence of "thermal" electrons to neutralize the 1-keV proton component of the space radiation environment were performed. Effects of each component of the simulated environment, and effects of the entire combined environment, as manifested in changes in reflectance properties of the coating specimens, were ascertained. Reflectance degradation resulting from exposure to the overall combined environment generally was found to be less than the sum of degradations sustained by exposure to components of the space environment. In contrast to predictions, the presence of "thermal" electrons as an additional component in half of the simulated environmental exposures resulted in only somewhat heavier damage to the reflectance properties of the coatings. Thus, the long-observed discrepancy between heavy coating damage indicated by interplanetary space flight data, and less damage shown by laboratory simulation of the interplanetary space environment is reduced, but still remains. Author

N70-13041*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE MIDLATITUDE IONIZATION TROUGH DURING THE RISING SOLAR CYCLE

N. J. Miller Aug. 1969 23 p refs Submitted for publication

(NASA-TM-X-63745; X-621-69-330) Avail: CFSTI CSCL 04A

Results of an analysis of Explorer 22 Langmuir probe measurements are presented for the winter periods between November 1, 1964 and February 15, 1967. The atmospheric region characterized by the data is the midlatitude ionization trough at 1000km. The electron density patterns imply that as solar activity increased, the trough position was unaffected but the density increased threefold. The latitudinal distribution of electron temperature exhibited a nightside maximum at the trough which showed negligible changes in amplitude, width, and location over the period of analysis. The nightside temperature maximum can be related to the plasmapause phenomenon by invoking field-aligned heat conduction from the protonosphere. Within the plasmasphere, heat conduction from hot protonospheric plasma can potentially produce temperatures that increase with latitude at 1000 km, whereas beyond the plasmapause the temperatures can decrease again because the greatly reduced densities retard the heat conduction process. Author

N70-13058# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

COSMIC RAY MT-64 MUON MONITOR DATA FROM SOLAR ROTATION 1813 TO ROTATION 1825, 20 JANUARY 1966 TO 5 JANUARY 1967

J. F. Steljes Sep. 1969 87 p refs

(AECL-3425; Rept-2) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $2.00

Hourly rates corrected for atmospheric temperature and pressure from four cosmic ray stations in Canada which have muon monitors and from a survey monitor stationed at Kula, Hawaii, are given in tabular form by solar rotation for the period from the beginning of Rotation 1813 to the end of Rotation 1825 (20 January 1966 to 5 January 1967). The Dorman-Maeda temperature correction factors for each station calculated at 12 hour intervals from the radiosonde data of the Canadian Meteorological Branch and the U.S. Weather Bureau are also listed. Barometric pressures are available from neutron monitor data reports already published. Graphs of the relative hourly rates at each station are given. Author

N70-13095*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POSITIVE ION COMPOSITION FROM A ROCKET-BORNE MASS SPECTROMETER

R. A. Goldberg and L. J. Blumle Aug. 1969 28 p refs Submitted for publication

(NASA-TM-X-63746; X-615-69-335) Avail: CFSTI CSCL 04A

A Nike Tomahawk was launched carrying a quadrupole mass spectrometer for measurement of positive ion composition in the ionosphere. The instrument was enclosed in a vacuum system principally controlled by a titanium getter pump, and marks the first attempt to use this technique for rocket experiments. A CW radio propagation experiment plus ground based ionosonde results enabled the reduction of the data to absolute values. Upon entry into the D region the vacuum system permitted spectra to be obtained to 68 km. D region results between 80 and 68 km show a predominance of positive 19 and 37 ions, possibly due to complex water clusters, marking the first independent observation in agreement with the earlier results of others. Author

N70-13231# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.

THE ELECTRIC FIELD IN THE SOLAR CORONAL EXOSPHERE AND THE SOLAR WIND

Hari K. Sen Oct. 1968 19 p refs *Its* Environ. Research Papers no. 292

(AD-678101; AFCRL-68-0506) Avail: CFSTI CSCL 3/2

The solar coronal exosphere (fixed at a level where the mean free path is comparable with the scale height) is shown to act like the sheath in a laboratory discharge, that builds up an excess positive charge and electric field. Equality of flux for the charged particles (protons and electrons) at the exosphere is assumed. The value of exospheric electric potential makes the protons virtually weightless. The exospheric sheath potential accelerates the thermal protons to a velocity of 258 km/sec, with which they coast to the earth. The proton density in transit varies approximately as the inverse square law. Higher velocities and densities are obtained for higher coronal temperatures. An estimate of the exospheric transition region is obtained by applying the hydrodynamic theory of ambipolar diffusion in a gravitational field to the observed coronal density distribution. Author (USGRDR)

N70-13270# Cornell-Sydney Univ. Astronomy Center, Sydney (Australia).

ULTRA HIGH ENERGY COSMIC RADIATION Final Report

C. B. A. Mc Cusker Nov. 1968 10 p refs

(Grant AF-AFOSR-676-66)

(AD-678210; AFOSR-68-2481) Avail: CFSTI CSCL 4/1

The purpose is to study all aspects of ultra high energy cosmic radiation. The array has been described in detail. TAB

N70-13384# Scientific Translation Service, Ann Arbor, Mich.

CONSIDERATIONS ON THE RISKS OF IONIZING RADIATIONS IN MANNED SPACE FLIGHTS. REPORT 1. NOTES ON IONIZING RADIATIONS IN EXTRATERRESTRIAL SPACE

G. Agati et al [1969] 24 p refs Transl. into ENGLISH from Minerva Radiol. (Torino), v. 13, 1968 p 324 - 334 Prepared for Oak Ridge Natl. Lab.

(ORNL-TR-1944) Avail: CFSTI

The risks of ionizing radiations in manned space flights are discussed, with emphasis on the composition and intensity of radiations in the geoatmosphere and in extra-atmospheric space. Within the scope of extra-atmospheric cosmic radiation, the hazards from primary cosmic radiation, solar radiation, radiation from the Van Allen belts, and auroral radiations are considered. After touching on the prospects of future astrophysical research, some data on the exposure of astronauts during the first space flights are presented. Author (NSA)

N70-13491# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

COSMIC RAY NM-64 NEUTRON MONITOR DATA, VOLUME 13

J. F. Steljes Sep. 1969 70 p

(AECL-3454) Avail: CFSTI

Uncorrected and barometer-corrected results from the cosmic ray stations in Canada using equipment maintained by AECL are given in tabular form for the period from May to August 1969. Normalized graphs are given for the same period. Author

N70-13544# Minnesota Univ., Minneapolis. Cosmic Ray Group.

THE HIGH ENERGY ELECTRON COMPONENT OF THE COSMIC RADIATION

T. M. K. Marar, P. S. Freier, and C. J. Waddington Jul. 1969 17 p refs

(Contract Nonr-710(60))

(AD-694463; CR-143; Conf-127) Avail: CFSTI CSCL 4/1

A composite stack of nuclear emulsions and lead sheets mounted in a spark chamber array triggered by scintillator and gas Cherenkov counters was flown to look for energetic electrons with E 6 or = 10 GeV. A considerable number of particles detected by the primary electrons have been traced into the nuclear emulsions and identified as not being electrons but particles making nuclear interactions. The number of identified electrons found corresponds to an intensity of electrons with E > 10 GeV of 0.08 +0.06 or

-.04 electrons /(meter squared) sr. sec. compared to the value of about 2 electrons per meter squared sr. sec. reported previously. In an attempt to understand why the results differ from those reported from a pure emulsion detector, a similar direct scan of a sample of the emulsions was made. Here again an electron intensity an order of magnitude or more below that predicted is found. The results combined with those obtained by spark chamber detectors suggest an integral energy spectrum. Author (TAB)

N70-13545# Minnesota Univ., Minneapolis. Cosmic Ray Group.
THE CHARGE SPECTRUM OF HIGH AND LOW ENERGY HEAVY NUCLEI IN THE COSMIC RADIATION
C. J. Waddington, P. S. Freier, and Charles E. Long Jul. 1969 19 p refs Presented at 11th Intern. Conf. on Cosmic Rays, Budapest, 1969
(Contract Nonr-710(60))
(AD-694462; CR-141; Conf-126) Avail: CFSTI CSCL 4/1

The charge spectrum of cosmic ray nuclei of sulphur and heavier ($Z > or = 16$) has been measured at high ($E > 7.1$ GeV/n), intermediate ($E > 1.58$ GeV/n), and low ($200 < or = E < or = 500$ MeV/n) energies. In each case nuclear emulsions flown on balloons were used to detect the nuclei and the ionization was measured using a semi-automated densitometer. These spectra are corrected to the top of the atmosphere and compared with those reported by other workers. The relationship of these spectra to those that might exist at hypothetical sources are considered in terms of the slab model of propagation through interstellar space and it is shown that the results are inconsistent with those obtained for lighter nuclei. A path length distribution that favors short path lengths and that is energy dependent, appears to provide the best fit to the data. Author (TAB)

N70-13834# Consiglio Nazionale delle Ricerche, Turin (Italy). Laboratorio di Cosmo-Geofisica. Torino (Italy).
ON CERENKOV RADIATION FROM EXTENSIVE AIR SHOWERS MEASURED BY HIGH SPEED TECHNIQUES [SULLA LUCE CERENKOV DA EAS MISURATA CON TECNICHE VELOCI]
G. Bosia, G. Navarra, and O. Saavedra [1969] 32 p refs In ITALIAN *Its* Rapporto Interno No. 8
Avail: CFSTI

The time distribution of the electromagnetic component of extensive air showers is studied by means of an analysis of the momentum of the associated Cerenkov radiation. Previous results have given widely divergent results owing to different properties of the experimental equipment. For this reason, a 'slow' channel with high efficiency and a high-speed channel have been combined. The impulse characteristics of the measured events were determined and histograms constructed. The experimental results are compared to theoretical predictions. ESRO

N70-13868# Turin Univ. (Italy). Ist. di Fisica Generale.
ON THE DIURNAL VARIATIONS OF THE COSMIC RAY INTENSITY OBSERVED AT 70 mwe UNDERGROUND
E. Antonucci, G. Cini Castagnoli, and M. A. Dodero [1968] 18 p refs Sponsored by Consiglio Nazl. delle Ric. *Its* Rapporto Interno No. 10
Avail: CFSTI

Some results of a study of diurnal intensity variations of high energy galactic cosmic rays observed at Mt. Cappuccini, Torino, during the years 1966/68 are presented. These variations are examined under two aspects: by studying average values over lengthy periods or on a day-to-day basis. Experimental results are compared with those derived by K.G. McCracken, taking into account the high energy particle trajectories in the sectorial interplanetary magnetic field. Author (ESRO)

N70-13870# Consiglio Nazionale Delle Ricerche, Turin (Italy). Laboratorio di Cosmo-Geofisica.
PROJECT FOR AN EXPERIMENT FOR THE TIME ANALYSIS OF EXTENDED SHOWERS AT 3500 m ALTITUDE [PROGETTO PER UN'ESPERIENZA SULL'ANALISI TEMPORALE DEGLI SCIAMI ESTESI IN ARIA A 3500 m]
G. Marangoni [1969] 17 p refs In ITALIAN *Its* Rapporto Interno No. 4
Avail: CFSTI

An experiment is proposed to analyze the longitudinal development of extensive air showers by photographing the emitted Cerenkov radiation by means of a streak camera. Taking account of the delays introduced by the photomultipliers, an optical delay must be introduced to trigger the camera. The extremely low intensity of the Cerenkov radiation calls for enhancement procedures, which it is proposed to perform by electronic amplification. ESRO

N70-13884# Consiglio Nazionale delle Richerche, Turin (Italy). Laboratorio di Cosmo - Geofisica.
SOLAR NEUTRINOS [I NEUTRINI SOLARI]
B. Beccio, A. Masani (Osservatorio Astron. di Milano), and G. Silvestro Jul. 1969 17 p refs In ITALIAN *Its* Rapporto Interno No. 9
Avail: CFSTI

Although the total neutrino flux from the sun is well known, the neutrino energy distribution depends strongly on the chains in the conversion from H to He. This is a survey of the results obtained by various authors on neutrino data. ESRO

N70-13897# Consiglio Nazionale delle Ricerche, Turin (Italy). Laboratorio di Cosmo-Geofisica.
OBSERVATION OF ANOMALOUS CERENKOV LIGHT PULSES FROM EAS
G. Bosia, C. Castagnoli, and M. Dardo [1969] 10 p refs *Its* Rapporto Interno No. 6
Avail: CFSTI

An analysis of anomalous Cerenkov pulses recorded at Testa Grigia Laboratory in Italy is presented. Some possible explanations for the three quoted anomalous pulses as observed by two very high speed RCA photomultipliers in comparison with the normal Extensive Air Shower (EAS) are given. ESRO

N70-13898# Consiglio Nazionale delle Ricerche, Turin (Italy). Laboratorio di Cosmo-Geofisica
RESULTS ON VARIATIONS OF HIGH ENERGY COSMIC RAYS [RISULTATI SULLE VARIAZIONI DEI RAGGI COSMICI DI ALTISSIMA ENERGIA]
43 p refs In ITALIAN Prepared jointly with Turin Univ. *Its* Rapporto Interno No. 3
Avail: CFSTI

A survey is given of the measurement of primary (high-energy) and secondary cosmic rays performed by various authors, both on satellites and at subterranean stations. After discussing the elimination of atmospheric effects, the solar diurnal and semidiurnal variations are presented, and possible sidereal variations are considered. Finally, the association of the Forbush decrease with solar phenomena is outlined. ESRO

N70-13923# Office National d'Etudes et de Recherches Aérospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
THE PROBLEM OF SIMULATION OF IONIZING RADIATION ENCOUNTERED IN SPACE. ACTION ON PLASTIC MATERIALS [PROBLEME DE LA SIMULATION DES RAYONNEMENTS IONISANTS RENCONTRES DANS L'ESPACE. CAS DES MATERIAUX PLASTIQUES]
A. Paillous Jul. 1969 40 p refs In FRENCH
(ONERA-NT-03-3-69) Avail: CFSTI

Simulation of space ionizing radiation is performed to evaluate

the action of radiation on materials. A critical study of the validity of simulation methods is presented after the action of radiation has been considered. Tests of the validity of radiation simulation conditions are discussed. ESRO

N70-13937# Consiglio Nazionale delle Richerche, Turin (Italy). Laboratorio di Cosmo-Geofisica.
PROJECT FOR AN EXPERIMENT TO MEASURE EXCESS NEGATIVE CHARGE IN EXTENSIVE AIR SHOWERS [PROGETTO DI UN'ESPERIENZA PER LA MISURA DELL'ECCESSO DI CARICA NEGATIVA NEGLI EAS]
L. Briatore and G. Silvestro. May 1969. 18 p. refs. In ITALIAN. Sponsored by Consiglio Nazl. delle Ric. Prepared jointly with Turin Univ. *Its* Rapporto Interno No. 5
Avail: CFSTI

The excess negative charge in extensive air showers is due to three processes: in-flight annihilation of positrons, Compton effect and gamma ray production. This excess results in unbalancing the ratio between coherent and incoherent Cerenkov radiation, which can then be detected by radio methods. In this paper the theoretical treatment by Askaryan is reviewed and a possibility of measuring this effect is discussed. For this purpose, a scintillation counter arrangement at 3500 m altitude was used.
ESRO

N70-13986# California Univ., Livermore. Lawrence Radiation Lab.
INVESTIGATION AND COMPARISON OF RADIOGENIC ARGON, TRITIUM, AND C-14 IN ATMOSPHERIC RESERVOIRS
W. R. Schell. 14 Apr. 1969. 38 p. refs. Presented at Nobel Symp., Uppsala, Swed., Aug. 1969. Sponsored by AEC
(UCRL-71653; Conf-690817-1) Avail: CFSTI

A study was started to determine the concentration of Ar-37 and Ar-39 in atmospheric samples. Since these radionuclides are cosmic-ray produced, the production rate in the atmosphere at any point should be dependent on the cosmic-ray flux. The concentration in samples collected should be dependent on the production from cosmic rays, the production from nuclear reactors, and nuclear detonations, and the air mass movement. The paper outlines basic problems in atmospheric reservoir mixing, and how measurement of samples for cosmic-ray produced argon can be utilized in environmental studies. New techniques were developed to separate and measure the low specific radioactivity of argon samples. Other gaseous radionuclides present in environmental air samples, HT, C-14, Xe, and Kr, can be measured using the equipment. Details of the equipment design are included. The first results of the Ar-37 concentration indicate sufficient radioactivity to measure by high-pressure gas counting.
Author (NSA)

N70-13988# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Deep River Lab.
COSMIC RAY MT-64 MUON MONITOR DATA FROM SOLAR ROTATION 1826 TO ROTATION 1839, JANUARY 6, 1967 JANUARY 18, 1968
J. F. Steljes. Oct. 1969. 100 p. refs. *Its* No. 3
(AECL-3453) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $2.00

Hourly rates corrected for atmospheric temperature and pressure from four cosmic ray stations in Canada which have muon monitors maintained by Atomic Energy of Canada Limited and from a survey monitor stationed at Kula, Hawaii are given in tabular form by solar rotation for the period from the beginning of Rotation 1826 to the end of Rotation 1839 (January 6, 1967 to January 18, 1968). The Dorman-Maeda temperature correction factors for each station calculated at 12 hour intervals from the radiosonde data of the Canadian Meteorological Branch or the U.S. Weather Bureau are also listed. Barometric pressures are available from neutron monitor data reports already published. Graphs of the relative hourly rates at each station are given.
Author

N70-14001# Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics Div.
INTRODUCTORY SURVEY OF RADIATION-BELT DIFFUSION
Carl-Gunne Fälthammar. Aug. 1969. 20 p. refs. Presented at the Advan. Study Inst. 'Earth's Particles and Fields', Santa Barbara, Calif., 4–15 Aug. 1969
(Rept-69-28) Avail: CFSTI

The role of radial diffusion in the dynamics of the radiation belts is discussed in the light of the most recent investigations. Analyses of the time variations of flux profiles using the Fokker-Planck equation are considered and data on the equilibrium states of the outer-zone soft protons and also of electrons are reviewed. It is shown that computing diffusion coefficients for outer belt electrons etc. from equilibrium considerations is difficult and that an outstanding difficulty in applying diffusion theory to the magnetosphere is the lack of knowledge of the relevant electric and magnetic perturbation fields.
ESRO

N70-14004# Danish Space Research Inst., Lyngby.
COSMIC RADIATION
B. Peters. Jan. 1969. 34 p. refs. Submitted for publication
Avail: CFSTI

This survey of cosmic ray research deals with the methods of detection and identification of solar, galactic, extragalactic and secondary cosmic rays, and discusses their propagation, energy spectra etc. and considers some important outstanding problems.
ESRO

N70-14013# RAND Corp., Santa Monica, Calif.
AGE OF COSMIC RAYS AND ABUNDANCE OF ANTIMATTER IN OUR GALAXY
L. Marshall Libby. Sep. 1969. 8 p. refs. Prepared in cooperation with Colorado Univ., Boulder
(AD-694383; P-4198) Avail: CFSTI CSCL 3/2

Acceptance of a disc-halo structure for the Galaxy together with cosmic ray evidence leads to the conclusion that cosmic rays are very old, older than 100 million years, and to the conclusion that the abundance of antimatter in the entire Galaxy is less than 0.0003.
Author (TAB)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-12709*# GCA Corp., Bedford, Mass. Technology Div.
STUDIES IN PLANETARY METEOROLOGY Annual Technical Report
George Ohring. Apr. 1969. 94 p. refs
(Contract NASw-1725)
(NASA-CR-107141; GCA-TR-69-8-N) Avail: CFSTI CSCL 03B

Calculations of the mean surface temperature of Venus are performed with a simple non-grey radiation balance model. The model is based upon a balance of net incoming solar radiation and emerging thermal radiation at the top of the atmosphere. To calculate the emerging thermal radiation, it is assumed that the shape of the vertical temperature profile is similar to that observed by Mariner 5 and Venera 4, that is, a constant lapse-rate of 9 C/km from the surface to a pressure level of a few tenths of an atmosphere, above which the temperature remains constant. Given

the atmospheric composition, cloud transmittance in the infrared, and surface pressure, the surface temperature can be determined from the balance requirement at the top of the atmosphere. Calculations are performed for a low surface pressure (20 atm) and high surface pressure (65 atm) model. For a pure carbon dioxide atmosphere, the results indicate that mean surface temperature of 500 K in the 65 atm can be maintained in the 20 atm model, and 650 K to 700 K in the 65 atm model, if water vapor mixing ratios are of the order 0.001. Author

N70-12731# Smithsonian Astrophysical Observatory, Cambridge, Mass.

THE EFFECT OF METEOROIDAL BOMBARDMENT ON SATURN'S RINGS

A. F. Cook and F. A. Franklin 26 Sep. 1969 38 p refs
(SAO SPECIAL Rept-304) Avail: CFSTI

This study tries to establish whether Saturn's rings are undergoing a loss or a gain of material as a result of impacts with interplanetary particles. Cometary meteoroids probably dominate over interstellar dust at Saturn, and meteoroids from comets like P/Comet Halley probably constitute the bulk of the interplanetary dust near Saturn. Most of the spalled fragments from the ring particles travel either to the other node or back to the node of origin and are recovered by the rings. Some fragments are lost into escaping orbits; rather more enter the planet's atmosphere. There is some doubt as to whether the rings are slowly accreting or losing matter, although our results somewhat favor the latter. Erosion as vaporized ice (steam) is probably quite negligible. The rate of impingement of spalled mass on Saturn is at most similar to that of meteoric mass. This is much too small to have any observable effect on the atmosphere. Author

N70-12828*# National Aeronautics and Space Administration, Washington, D.C.

MARS SURFACE MODELS (1968) NASA Space Vehicle Design Criteria (Environment)

Andrew J. Beck (JPL) and E. Christiaan de Wys (JPL) May 1969 74 p refs
(NASA-SP-8020) Avail: CFSTI CSCL 03B

Engineering models of the mechanical, electrical, and thermal properties of the Mars surface which are required for the design of vehicle landing and operation on the Martian surface are presented. The properties are based on the current knowledge of Mars obtained from earth-bound telescopic and radar observations, and Mariner 4 spacecraft observations. The Martian surface properties for selected areas are summarized in tables. F.O.S.

N70-12883*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ESTIMATION AND PREDICTION OF THE ATTITUDE OF A PASSIVE GRAVITY-STABILIZED SATELLITE

Bruce E. Tinling and Vernon K. Merrick Washington Dec. 1969 31 p refs
(NASA-TN-D-5592; A-3283) Avail: CFSTI CSCL 22C

Essential to the estimation and prediction technique is the selection of a simple observable set of satellite parameters which, if known, permits the disturbance torques to be approximated. The values of the parameters were established by analyzing a large number of imperfect observations and the attitude was subsequently calculated by integration of the equations of motion. A significant result of the study is that the parameters can be estimated solely from solar aspect information. The technique was evaluated by a simulation study. The simulated satellite was assumed to be in a polar orbit at an altitude of 1400 km and to have solar aspect sensors digitized to have a sensitivity of 0.5 deg per digit. The results indicated that past attitude history could be estimated to within 0.1 deg. Application of the technique to long-range prediction produced the same errors in earth pointing, but the yaw errors were approximately doubled. Author

N70-12897*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A COMPUTER PROGRAM VERSION OF THE BROUWER ORBITAL THEORY WITH OPTIONAL MODIFICATIONS

Hans G. Hertz Aug. 1969 203 p refs
(NASA-TM-X-63747; X-552-69-338) Avail: CFSTI CSCL 22C

This report describes a program which computes osculating elements and position-velocity vectors in an earth satellite orbit according to the Brouwer theory. Options for certain modifications have been added. Basic orbital data are written on a tape called orbital tape which may be used as input to other programs for further processing. The program written in FORTRAN 4 for the IBM 360 computer is an adaptation of a program constructed and described by Repass and Cheplick. Author

N70-12925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ACCELERATIONS ON 24-HOUR SATELLITES AND LOW ORDER LONGITUDE TERMS IN THE GEOPOTENTIAL

Carl A. Wagner Nov. 1969 21 p refs
(NASA-TM-X-63752; X-552-69-508) Avail: CFSTI CSCL 22C

The tracking record of six 24-hour satellites has been analysed and reduced to a set of 35 well determined accelerations due to the anomalous geopotential. The record covers the years 1963-1969 and has a fair distribution in longitude. From this record two "best" resonant geopotential fields to fourth order are derived as well as new locations of the four east-west equilibrium points for the geostationary satellite. There is considerable improvement in the low order field of other recent (1969) gravity models, in contrast to the "best" models in 1966, as judged by this 24-hour acceleration data. Author

N70-12991*# California Univ., Berkeley.

MATERIAL STUDIES RELATED TO LUNAR SURFACE EXPLORATION. VOLUME 1: LUNAR SOIL MECHANICS AND SOIL PROPERTIES Final Report, 6 Mar. 1967 – 30 Jun. 1968

J. K. Mitchell, I. S. E. Carmichael, R. E. Goodman, J. Frisch, P. A. Witherspoon et al Mar. 1969 172 p refs
(Contract NSR-05-003-189)
(NASA-CR-107178) Avail: CFSTI CSCL 03B

Various aspects of lunar soil mechanics and soil properties are studied in order to develop a design capability for spacecraft landing and lunar surface mobility systems. Geotechnical engineering problems related to lunar exploration are identified and possible methods for their determination suggested. An appendix contains key word listings for a library of lunar exploration reports built up in support of the above outlined research. G.G.

N70-12992*# California Univ., Berkeley.

MATERIAL STUDIES RELATED TO LUNAR SURFACE EXPLORATION. VOLUME 2: APPLICATION OF GEOPHYSICAL AND GEOTECHNICAL METHODS TO LUNAR SITES EXPLORATION Final Report, 6 Mar. 1967 – 30 Jun. 1968

J. K. Mitchell, I. S. E. Carmichael, R. E. Goodman, J. Frisch, P. A. Witherspoon et al Mar. 1969 87 p refs
(Contract NSR-05-003-189)
(NASA-CR-107175) Avail: CFSTI CSCL 03B

The application of geophysical and geotechnical methods to lunar site studies is evaluated in detail in an effort to develop pertinent design data for spacecraft landing and mobility systems as well as for the design of scientific experiments on lunar soil. Emphasis is placed on investigating rock behavior and strength, stress measurements in rocks, and rock deformability in bore holes. G.G.

N70-12993*# California Univ., Berkeley.
MATERIAL STUDIES RELATED TO LUNAR SURFACE EXPLORATION. VOLUME 4: PRELIMINARY STUDIES FOR THE DESIGN OF ENGINEERING PROBES Final Report, 6 Mar. 1967 - 30 Jun. 1968
J. K. Mitchell, I. S. E. Carmichael, R. E. Goodman, J. Frisch, P. A. Witherspoon et al Mar. 1969 82 p refs
(Contract NSR-05-003-189)
(NASA-CR-107173) Avail: CFSTI CSCL 03B

Preliminary studies for the design of lunar engineering probes are outlined. Particular attention is given to the development and testing of a borehole jack that produces nonhomogeneous stress and displacement fields in the rock around the borehole. A comparison of test results from several areas established the borehole jack device as well suited to measurements of rock deformability. Also proposed are several devices for determining permeability and thermal conductivity of the lunar surface under assumption that the lunar material is homogeneous and isotropic for both fluid and heat flow; the nuclear quadrupole resonance thermometer is given serious consideration as is the possible use of remote sensing probes. G.G.

N70-12994*# California Univ., Berkeley.
MATERIAL STUDIES RELATED TO LUNAR SURFACE EXPLORATION Technical Summary Report, 6 Mar. 1967 - 30 Jun. 1968
J. K. Mitchell, I. S. E. Carmichael, R. E. Goodman, J. Frisch, P. A. Witherspoon et al Apr. 1969 50 p refs
(Contract NSR-05-003-189)
(NASA-CR-107174) Avail: CFSTI CSCL 03B

Summarized are engineering and scientific studies of lunar surface material properties prior to the first lunar landing. Results on lunar soil mechanics and rock surface materials are related to engineering problems in the design of spacecraft landing and surface mobility systems, the design of experiments to be conducted on the lunar surface, mission planning and mission success. Analyses and testing methods are developed that appear promising for the study of lunar surface properties by both remote control and tactile means. G.G.

N70-13031# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 213 1 Oct. 1969 p 1 - 16 refs (See N70-13030 03-13)
Avail: CFSTI

A brief summary is presented of a recent Soviet publication in which it is shown that results obtained in studying waves from a cylindrical explosion are fully applicable to phenomena associated with shock wave formation during movement of large meteor bodies in the atmosphere. The installation of a large transit instrument installed in a Chilean observatory for absolute determination of right ascensions of stars is reported, and the astrodynamic characteristics of flight in an earth-moon trajectory are also mentioned. Evidence from earlier satellites of a dust cloud around the earth is refuted, based on data from detectors aboard Cosmos 135 which indicate that the phenomena were actually due to thermal effects. Abstracts of scientific articles dealing with astrophysics, meteorology, geomagnetism, and astronomical observations are also included. A.C.R.

N70-13081# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH IN THE USSR IN 1968
Yu. I. Efremov, ed. 1 Aug. 1969 111 p refs Transl. into ENGLISH of the publ. "Issledovaniya Verkhney Atmosfery i Kosmicheskogo Prostranstva Vypolnennyye v 1968 Godu" Moscow, Nauka Publishing House, 1969 Presented at 12th COSPAR Plenum, Prague
(JPRS-48528) Avail: CFSTI

This report briefly describes the basic results of space studies whose results were fully or partially analyzed during 1968. Topics covered include the Moon and planets, investigation of physical processes and phenomena transpiring in space, short-wave electromagnetic radiation at the Sun and stars, meteorological research, biomedical research, furhter development of technical means for the conquest of space, communication systems, and use of satellites for communication and weather. NSA

N70-13207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR SURVEYOR MISSION 7. VOLUME 6
N. A. Renzetti 1 Dec. 1969 205 p
(Contract NAS7-100)
(NASA-CR-107185; JPL-TM-33-301-Vol-5) Avail: CFSTI CSCL 22C

This report covers the Tracking and Data System (TDS) activities for *Surveyor 7*, from the time the requirements were established by the project objectives and the spacecraft design, through the preparation of the network-support plans, the implementation of the necessary facility configurations, the performance of the requisite tests to establish operational readiness, the support of the actual flights to the end of each mission—with a comprehensive account of the tracking operations, and an evaluation of that support. To better define the requirements on the TDS, the *Surveyor* Mission objectives are reviewed and descriptions of the *Atlas/Centaur* launch vehicle and of the spacecraft are included, as is the synopsis of the seventh *Surveyor* flight. Associated equipment and activities of the three elements of the Deep Space Network, which meet the metric, telemetry, command, and tracking demands of the missions are documented. Technical and statistical data concerning launch, trajectory, operating modes, tracking time, received-signal levels, command lockups, and data transmission and reduction are presented. Author

N70-13413# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 215 30 Oct. 1969 p 1 - 6 refs (See N70-13412 03-13)
Avail: CFSTI

News articles and abstracts on astronomy are presented. Quasars are described, emphasizing one in Crab Nebula which has pulsations in the visible spectrum. Work on the construction of the Turkmen and Mount Semirodnika telescopes is reported. Varying degrees of reflectivity from the lunar surface and the distribution of radio brightness over the Venus disk were observed. Data on planetary atmospheres compositions and temperatures are reviewed, and a new television system for observing solar granulation is described. N.E.N.

N70-13476*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE ROLE OF STAGED SPACE PROPULSION SYSTEMS IN INTERPLANETARY MISSIONS
Duane W. Dugan Washington Dec. 1969 54 p refs
(NASA-TN-D-5593) Avail: CFSTI CSCL 21H

Conditions for obtaining maximum performance of tandem stages of space propulsion systems are examined by means of theoretical analyses and with a numerical simulation of the trajectories flown. The often-used assumption that the inert fraction is constant is shown to yield unduly optimistic predictions compared with the numerical results or with results of an analytic method based on more realistic scaling laws for inert masses. The computerized numerical method is used to assess advantages of staging chemical and nuclear propulsion systems in several high-energy interplanetary missions for which single-stage performance is inadequate. Author

N70-13485# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 214 14 Oct. 1969 p 1-5 refs (See N70-13484 03-13)
Avail: CFSTI

A two channel television telescope is described, which amplifies the brightness of celestial bodies barely visible to the naked eye, and converts images to a kinescope screen display. The radio emission of the new pulsar PP 0943 and the broad range of its physical characteristics are discussed, as well as the origin of emission lines in the optical spectra of radiogalaxy and Seyfert galaxy nuclei. It is proposed in the latter case that the decay energy of radioactive elements explains the appearance of emission lines. M.H.E.

N70-13520# North Carolina Univ., Chapel Hill. Dept. of Physics
RELATIVITY AND COSMOLOGY Final Scientific Report
H. P. Robertson and T. W. Noonan Oct. 1968 495 p refs
(Grant AF-AFOSR-761-65)
(AD-678054; AFOSR-68-2194) Avail: Paper Copy Available from W. B. Saunders Co., West. Wash. Square, Philadelphia, Pa. CSCL 20/10

Relativity and Cosmology is a presentation of the fundamentals of special relativity, general relativity, and cosmology with particular emphasis and development of (1) the electromagnetic stress-energy tensor in special relativity, (2) the poynting-Robertson effect, (3) the experimental basis for special-relativistic gravitational theories, (4) the geometric foundation for Reimannian geometry, (5) the derivation of the cosmological metric from group theory, (6) a discussion of cosmological models, (7) rotation of coordinate systems in general relativity, (8) electromagnetism in media in general relativity, (9) rotationally symmetric general-relativistic solutions, (10) Godel's cosmological model, and (11) geodesic precession. TAB

N70-13551# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section
ON THE ACCURACY OF THE ORBITAL ELEMENTS OF ARTIFICIAL EARTH SATELLITES [O TOCHNOSTI ELEMENTOV ORBIT ISKUSSTVENNYKH SPUTNIKOV ZEMLI]
A. S. Sochilina Jul. 1969 27 p refs Transl. into ENGLISH from Byull. Inst. Teor. Astrom., (Leningrad), v. 11, No. 1 (124), 1967 p 18-32
(AD-693862; ACIC-TC-1540) Avail: CFSTI CSCL 22/3

The criterion for choosing intervals of time has been obtained when the improvement of orbit elements of artificial earth satellites is performed by the least squares method. The time interval is to be chosen in such a way that the residuals of the equations of observation should be bias-free. The formulae for computing the weight coefficients of the corrections to elements have been also derived. On the basis of these formulae, the criterion has been established permitting to exclude the elements with large errors from the refinement process. An example of the criteria mentioned above has been given in this work. Author (TAB)

N70-13561# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 212 16 Sep. 1969 p 1-6 refs (See N70-13560 03-13)
Avail: CFSTI

Geological data of the moon obtained by lunar probes and landings are summarized and the need for a laboratory on the surface is emphasized. Abstracted data are presented on studies of large solar radio bursts observed during the IGY-IGC period and of the diurnal and seasonal variations in radio wave propagation in the atmosphere. N.E.N.

N70-13648# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Center.
PHOTOMAP OF THE VISIBLE HEMISPHERE OF THE MOON, 1:5,000,000 SCALE [FOTOKARTA VIDIMOGO POLUSHARIYA LUNY, MASSHTAB 1:5,000,000]
Yu. N. Lipskii Nov. 1968 9 p Transl. into ENGLISH from Gos. Astron. Inst. Im. P. K. Shternberga and Topogeodezicheskaya Sluzhba SSR (Moscow), 1967
(AD-677785; ACIC-TC-1436) Avail: CFSTI CSCL 8/2

Photomap of the moon's visible hemisphere compiled on the basis of original photographs received from native and foreign observatories, with additional materials from photographic atlases of the Moon. The chart was drawn in an oblique, positive, exterior, perspective projection with positive libration values in altitude and longitude close to the maximum, which creates conditions of visibility of the eastern limb zone. This zone connects the visible hemisphere with the western sector of the far side of the moon, which was photographed by A.M.S. Luna 3 in 1959. Author (TAB)

N70-13699# Consiglio Nazionale Delle Ricerche, Turin (Italy). Inst. di Fisica dell'Atmosfera.
STRUCTURE AND FRAGMENTATION OF METEOROIDS
Franco Verniani May 1969 72 p refs Submitted for publication
(IFA-RDP-26) Avail: CFSTI

A summary of the evidence concerning the common occurrence of fragmentation among both photographic and radio meteors is given. An attempt is made to examine all the present observational, theoretical and laboratory data on the luminous and ionizing efficiencies of meteors, with the aim of establishing a mass scale. This allows the computation of the bulk density of meteoroids, which averages about 0.3 g/cu cm. The paramount importance of progressive fragmentation, the behavior of abrupt-beginning meteors and the low density of nearly all meteoroids (even of those of relatively large sizes) support a porous and fragile structure for most of these particles. In turn, the crumbly structure and the cometary origin confirm Whipple's theory of comets and meteor production. A critical analysis of recent papers proposing different conclusions shows that the new theories always arrive at results which do not agree with well-established observational data. Author (ESRO)

N70-13708# Royal Greenwich Observatory, Herstmonceux (England).
FIRST GREENWICH CATALOGUE OF STARS FOR 1950.0
1969 201 p refs *Its* Roy. Obs. Ann. No. 3
Avail: CFSTI

This catalogue contains the results of the observations of stars made at Greenwich with the Airy Transit Circle from 1 January 1931 to 12 September 1940. Observed right ascension and declination are given. ESRO

N70-13816# Naval Weapons Center, Corona Labs., Calif.
RELATIVE TRAJECTORY DATA REDUCTION ANALYSIS
Kenneth W. Grant Sep. 1969 87 p refs
(AD-694470; NWCCL-TP-882) Avail: CFSTI CSCL 16/2

Knowledge of missile/drone intercept parameters is extremely important in the analysis of ordnance system performance. Because of the expense of missile/drone tests, the best possible data reduction ought to be performed. Several techniques have been established to reduce the film data, which is the primary source of information in this type of test. The procedure described herein is based on statistical techniques which eliminate many of the difficulties inherent in previous reduction techniques. It eliminates the need for film timing marks, permits the use of cameras of varying frame rates, checks and discards erroneous data, and calculates probability contours, specifying the precision of the reproduced intercept situation. Author (TAB)

N70-13820*# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 6, PART 4, NO. 100-104
Gerard P. Kuiper, ed. 1969 89 p refs
(Grants NGL-03-002-002; NGL-03-002-091)
(NASA-CR-107052) Avail: CFSTI CSCL 03B

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2. NO. 101. IDENTIFICATION OF THE VENUS CLOUD LAYERS G. P. Kuiper p 229-250 refs (See N70-13822 03-30)

3. NO. 102. VENUS PHOTOGRAPHS. PART 1 - PHOTOGRAPHS OF VENUS TAKEN WITH THE 82-INCH TELESCOPE AT MC DONALD OBSERVATORY, 1950-56 G. P. Kuiper, J. W. Fountain, and S. M. Larson p 251-262 (See N70-13823 03-30)

4. NO. 102. VENUS PHOTOGRAPHS. PART 2 - MULTICOLOR PHOTOGRAPHY OF VENUS, 1962 W. K. Hartmann p 262-264 refs (See N70-13824 03-30)

5. NO. 102. VENUS PHOTOGRAPHS. PART 3 - UV PHOTOGRAPHS OF VENUS TAKEN WITH THE 61-INCH NASA TELESCOPE, 1967 J. Fountain and S. Larson p 264-274 refs (See N70-13825 03-30)

6. NO. 103. THE INFRARED SPECTRUM OF JUPITER, 0.95-1.60 MICRONS, WITH LABORATORY CALIBRATIONS D. P. Cruikshank and A. B. Binder p 275-288 refs (See N70-13826 03-30)

7. NO. 104. NEW MULTICOLOR FILTER PHOTOMETRY OF MARS R. I. Mitchell p 289-294 refs (See N70-13827 03-30)

N70-13821*# Arizona Univ., Tucson.
NO. 100. HIGH-ALTITUDE SPECTRA FROM NASA CV-990 JET. PART 2. WATER VAPOR ON VENUS
G. P. Kuiper, F. F. Forbes, D. L. Steinmetz, and R. I. Mitchell *In its* Commun. of the Lunar and Planetary Lab., Vol. 6, PT. 4, No. 100-104 1969 p 209-228 Presented at the 2d Planetary Conf., Tucson, Ariz., 12 Mar. 1968 (See N70-13820 03-30)
Avail: CFSTI CSCL 03B

Venus and Moon spectra obtained with a new interferometer are presented. The ratio spectrum Venus/Moon is also derived which eliminates remaining weak telluric absorptions as well as solar absorption lines of any strength. The ratio spectrum shows Venus essentially as if illuminated in white light, allowing a direct comparison with laboratory spectra. A lunar spectrum with increased precision was obtained allowing the computation of an improved ratio spectrum for Venus. Finally, ground-based Venus and Moon spectra, and their ratio, are added for increased precision of the Venus spectrum outside the telluric H2O bands. Examination of the effect of the Doppler shift of the planet shows that, for the 1.4 and 1.9 microns H2O bands, the telluric and Venus lines are completely separated, so that the ratio spectrum represents Venus correctly; but that the lines of the 2.6 microns H2O band, many of which are fairly strong and double in the telluric spectrum even at 200 mb, will generally not be separated and will give complex superposition effects with Venus. Calibration of the 1.4 microns and 1.9 microns bands shows the amount of H2O in the Venus spectrum to be about 5 microns precipitable water. This positive identification of water vapor supersedes the upper limit of roughly 2 microns. The observed amounts of trace constituents, such as H2O, will, for constant mixing ratios, vary with the amount of CO2 observed, known to be variable from day to day as well as systematically with phase. Author

N70-13822*# Arizona Univ., Tucson.
NO. 101. IDENTIFICATION OF THE VENUS CLOUD LAYERS
Gerard P. Kuiper *In its* Commun. of the Lunar and Planetary Lab., Vol. 6, PT. 4, No. 100-104 1969 p 229-250 refs (See N70-13820 03-30)
Avail: CFSTI CSCL 03B

Observations establish the existence of two well-separated cloud layers on Venus: (1) a patchy layer observed in photographs taken at wavelength < 4200 A, apparently consisting of bright veils often thousands of km in size, which at times exhibit retrograde motions up to 100 meters/sec., composed of particles about 0.1 microns diameter; and (2) a yellowish, optically impenetrable layer exhibiting gross horizontal structure only rarely, but having a variable upper boundary situated well within the troposphere. New diameter measures of the planet, coupled with recent data on the atmospheric temperature profile indicate that the *UV layer occurs in the upper stratosphere*, near the mesopause; and confirm that the boundary of the *thick yellow haze layer* is just below the tropopause, *within the troposphere*. With the known mixing ratio H2O/CO2 for the upper Venus troposphere, the possibility of water or ice clouds in the visible layers can be dealt with definitively. A compilation of published photometric data from 0.2-4.0 microns and new spectrophotometric data compared to new laboratory measures show that *the chief constituent of the yellow haze layer* is incompletely-hydrated FeCl2; three absorption bands observed on Venus are attributed to Fe(2+) and one each of Fe-H2O, Fe-Cl and O-H. The vapor pressure of H2O measurements in the upper troposphere of Venus is found to be essentially equal to *the equilibrium dissociation pressure of the Venus cloud particles* and is so interpreted. The published H2O measurements by Venera 4-8 for the deeper layers are discussed but found to be incompatible with well-established results. It is concluded that *Venus has a halide meteorology*, compared to a water meteorology on Earth, and an ammonia meteorology in Jupiter and Saturn. Author

N70-13823*# Arizona Univ., Tucson.
NO. 102. VENUS PHOTOGRAPHS. PART 1 - PHOTOGRAPHS OF VENUS TAKEN WITH THE 82-INCH TELESCOPE AT MC DONALD OBSERVATORY, 1950-1956
G. P. Kuiper, J. W. Fountain, and S. M. Larson *In its* Commun. of the Lunar and Planetary Lab., Vol. 6, PT. 4, No. 100-104 1969 p 251-262 (See N70-13820 03-30)
Avail: CFSTI CSCL 03B

Observational data obtained from Venus photographs taken in the ultraviolet or longer wavelength show that indistinct markings are at times visible in both the yellow and the near infrared but are much more contrasting at ultraviolet wavelength observations. The ultraviolet cloud pattern varied not only from day to day but also over a period of a decade. G.G.

N70-13824*# Arizona Univ., Tucson.
NO. 102. VENUS PHOTOGRAPHS. PART 2 - MULTICOLOR PHOTOGRAPHY OF VENUS, 1962
William K. Hartmann *In its* Commun. of the Lunar and Planetary Lab., Vol. 6, Pt. 4, No. 100-104 1969 p 262-264 refs (See N70-13820 03-30)
Avail: CFSTI CSCL 03B

A series of Venus photographs at multicolor wavelengths and with various liquid filters were evaluated for possible anomalous markings that might be associated with the observed anomalous polarization at 3140 A. However, since no anomalous markings were observed when a 3140 A filter was used it was concluded that the variability in ultraviolet polarization was not connected with any changes in the apparent structure of the cloud markings observed at that wavelength. G.G.

N70-13825*# Arizona Univ., Tucson.
NO. 102. VENUS PHOTOGRAPHS, PART 3 - UV PHOTOGRAPHS OF VENUS TAKEN WITH THE 61-INCH NASA TELESCOPE, 1967
J. Fountain and S. Larson *In its* Commun. of the Lunar and Planetary Lab., Vol. 6, Pt. 4, No. 100-104 1969 p 264-274 refs (See N70-13820 03-30)
Avail: CFSTI CSCL 03B

Ultraviolet composite photographs of Venus of improved contrast were obtained by copying several images with careful registration. Averaging of densities in the grain distribution and, therefore, increases with the square root of the number of originals used, allowed the recognition of low contrast clouds difficult to detect in the originals. Positive prints of the manual dodged negatives, with reduced intensity gradients towards the terminator, ensured accurate representation of all details. The prints were reproduced at a scale of about 2.5 mm per arc second. G.G.

N70-13826*# Arizona Univ., Tucson.
NO. 103. THE INFRARED SPECTRUM OF JUPITER, 0.95-1.60 MICRONS, WITH LABORATORY CALIBRATIONS
Dale P. Cruikshank and Alan B. Binder *In its* Commun. of the Lunar and Planetary Lab., Vol. 6, PT. 4, No. 100-104 1969 p 275-288 refs (See N70-13820 03-30)
Avail: CFSTI CSCL 03B

New spectra of Jupiter in the region 0.95-1.60 microns are presented with calibrations from laboratory studies of the bands of CH4 and NH3. Estimates of the quantities of these gases above the effective reflecting layer in the Jupiter atmosphere are given for each of several individual bands. The presence of C2H2, H2S, and HCN is investigated with the aid of composite spectra of these gases in addition to CH4 and NH3. We find as upper limits 8 cm-atm for C2H2, 50 cm-atm for H2S, and 10 cm-atm for HCN. Author

N70-13827*# Arizona Univ., Tucson.
NO. 104. NEW MULTICOLOR FILTER PHOTOMETRY OF MARS
Richard I. Mitchell *In its* Commun. of the Lunar and Planetary Lab., Vol. 6, Pt. 4, No. 100-104 1969 p 289-294 refs (See N70-13820 03-30)
(Grant NSF GP-4999)
Avail: CFSTI CSCL 03B

New photometry of Mars for the wavelength region 0.33 - 5.0 microns with broad and medium-narrow filters is presented. The observations show a variation of 10 percent in whole-disk reflectivity in the 1 microns region. The reflectivity of Mars is found to decrease between 2.2 and 3.5 microns. The integrated albedo is found to be 0.31 + ot - .03 pe. The apparent 5 microns brightness temperature is 243 K for the 1967 opposition period. Author

N70-13847# Royal Greenwich Observatory, Herstmonceux (England).
LINE INTENSITIES IN THE VISUAL REGION OF MU CASSIOPEIAE
R. M. Catchpole, B. E. J. Pagel, and A. L. T. Powell 1969 16 p refs *Its* Roy. Obs. Bull. No. 154
Avail: CFSTI

This paper lists equivalent widths and other relevant data for spectral lines of the mild subdwarf mu Cassiopeiae measured on four Palomar coudé exposures in the visual region taken by J. L. Greenstein in 1963. The analysis of the data has been published elsewhere. Author (ESRO)

N70-13863# Joint Publications Research Service, Washington, D.C.
SUBMILLIMETER ASTRONOMY
A. Ye. Salomonovich 24 Nov. 1969 24 p refs Transl. into ENGLISH from Priroda (Moscow), No. 9, 1969 p 18-29
(JPRS-49303) Avail: CFSTI

A state of the art review on submillimeter wave astronomy is presented, stressing advances in radiometer equipment, and balloon, satellite, and rocket-borne observations. Theoretical data on the layer below the surface of the moon and planets, and on chromospheric outbursts of the sun are cited. J.A.M.

N70-14002# Junkers Flugzeug- und Motorenwerke A. G., Munich (West Germany).
THE MOTION OF LIBRATION POINTS [DIE BEWEGUNG DER LIBRATIONSPUNKTE]
J. Tschauner Sep. 1969 38 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMWF-FB-W-69-35) Avail: CFSTI

The motion of a small body in the gravitational field of two heavy masses is investigated for the case when the masses revolve on elliptic orbits around their common mass center. The highly nonlinear equation on this motion are reduced to the simplest form by a suitable normalization of the coordinates and by the use of the true anomaly of the revolution as an independent variable. This form clearly shows a similarity to the case of circular revolution usually considered, but also shows the differences which are to be taken into account in the elliptic case. The equations of motion have five stationary solutions similar to the circular case, e.g. the five libration points. The motion of the small body in the neighborhood of these points, described by linear differential equations with periodic coefficients is considered in detail. Author (ESRO)

N70-14008# Joint Publications Research Service, Washington, D.C.
FUNDAMENTALS OF MATHEMATICAL MODELING OF PLANETARY ATMOSPHERES
M. Ya. Marov et al 17 Dec. 1969 45 p refs Transl. into ENGLISH of the book 'Osnovy Matematicheskogo Modelirovaniya Planetnykh Atmosfer' Moscow, 1969 75 p
(JPRS-49468) Avail: CFSTI

The principal equations which determine the structure and dynamics of planetary atmospheres are examined. Generalized hydrodynamic equations for the upper atmosphere are formulated in a phenomenological way using the methods of thermodynamics of irreversible processes. The results of the kinetic theory are used for the transfer coefficients. Author

N70-14027# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 216 14 Nov. 1969 p 1-3 refs (See N70-14026 03-13)
Avail: CFSTI

The hypothesis that comets are composed of antimatter from antiworlds and evidence supporting the hypothesis are briefly discussed. The slowing up of the comet when it gets close to the sun, and the characteristic two gamma-quanta spectral line of the positron - electron annihilation observed by satellites when meteors enter the atmosphere are given as supporting evidence. An abstract is presented of a book which reviews methods of determining the lunar figure and gravity field. These methods are based on the internal structure of the moon, the moon's motion, and the motions of artificial satellites. The construction of the Zelenchukskaya Astrophysical Observatory is reported completed. N.E.N.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-12716*# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
DESCRIPTION OF A GENERAL LAUNCH VEHICLE SIMULATION PROGRAM AND ITS ASSOCIATED DATA PROGRAM
G. R. Hewitt Dec. 1967 38 p refs
(Contract NAS8-20082)
(NASA-CR-102333; LSMC/HREC-A791043) Avail: CFSTI CSCL 22B

The derived system of equations of motion describes a flexible, sloshing vehicle model in the pitch plane and is complete to the extent required to perform load relief analysis and performance evaluation for the Saturn 5 class of launch vehicles. General descriptions of the background material of the two digital programs are presented. R.B.

N70-12732*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THRUST AUGMENTED THOR-AGENA PERFORMANCE FOR THE ORBITING GEOPHYSICAL OBSERVATORY OGO-4 MISSION
Washington Dec. 1969 81 p
(NASA-TM-X-1932; E-5064) Avail: CFSTI CSCL 22B

The Thrust Augmented Thor-Agena successfully launched the Orbiting Geophysical Observatory-4 into a low-altitude, near-polar elliptical trajectory. The spacecraft was launched from the Western Test Range in July, 1967, for the purpose of conducting a series of scientific experiments. This report discusses the performance of the Thrust Augmented Thor-Agena launch vehicle from lift-off through spacecraft separation. Author

N70-12777# Sandia Corp., Livermore, Calif.
EFFECTS OF INADEQUATE MATHEMATICAL MODELS ON DYNAMIC DATA ANALYSIS
J. K. Kryvoruka Sep. 1969 70 p refs
(Contract AT(29-1)-789)
(PB-186107; SCL-DR-69-84) Avail: CFSTI CSCL 16B

The method of differential corrections fitting is applied to linearly generated, missile dynamic data. A very pronounced distortion in the form of oscillations is found in the resulting parameters due to extraneous frequencies; these oscillations are found to be functions of both the fit and unfit data frequencies, and produce errors in the determination of the various missile stability parameters and coefficients. Methods are given to determine the exact nature and first approximations of unknown frequencies such that complete fits can be made and erroneous distortions removed from the parameters and accurate stability coefficients obtained. The resulting phenomena are investigated and determined for various types of fitting, and an application is made to actual test data. Author (USGRDR)

N70-12829*# Arizona Univ., Tucson. Lunar and Planetary Lab.
ORBITING ASTRONOMICAL OBSERVATORY Final Report (Including Status Reports for 1 Dec. 1967 - 30 Jun. 1968 and 1 Jul. 1968 - 31 Mar. 1969)
H. L. Johnson, T. Gehrels, F. A. de Wiess, and F. F. Forbes Jun. 1969 31 p refs
(Contract NSR-03-002-048)
(NASA-CR-107142) Avail: CFSTI CSCL 22B

The research activities of the Lunar and Planetary Laboratory are reported in the following areas: orbiting astronomical observing facility, photopolarimeter development, fine error sensor evaluation, Fourier spectrometer development, ground-based photometry, and ground-based polarimetry. Abstracts of pertinent references are included. F.O.S.

N70-13471*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
STATIC ELECTRICITY IN THE APOLLO SPACECRAFT
Andrew E. Potter, Jr. and Benny R. Baker Washington Dec. 1969 22 p refs
(NASA-TN-D-5579) Avail: CFSTI CSCL 22B

Static electricity ignition hazards in the Apollo spacecraft were studied. Sparks with energies up to 2 millijoules can be generated by a space-suited man. This amount is sufficient to ignite flammable gas vapors and mists, but is not sufficient to ignite flammable solids such as logbook paper and cotton cloth present in the Apollo spacecraft. Biomedical sensors were used to ground the space-suited man to the spacecraft and eliminate static electricity ignition hazards. Temporary interference with cardiac readings from the biomedical sensors occurred during static charge drainage. This interference was minimized by adding a 0.1- to 1-megohm resistor in parallel to the ground circuit. Insulating fabrics used for the couch covers became electrified during use. The electrostatic charge on the couch covers was minimized by installing a grounded metal screen underneath the couch cover fabric. Storage lockers on the spacecraft floor and lithium hydroxide canisters stowed in the storage lockers were capable of accumulating several millijoules of electric energy before they were grounded to the spacecraft structure. No evidence existed of static electricity interference with the operation of the communications system of the portable life support system. Author

N70-13665# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, MAY 1969
R. D. Eberst 11 Aug. 1969 10 p
(ROE-STS-89) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during May 1969 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N70-13707# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JULY 1969
R. D. Eberst 30 Sep. 1969 17 p
(ROE-STS-91) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during July 1969 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N70-13769# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JUNE 1969
R. D. Eberst 22 Sep. 1969 20 p
(ROE-STS-90) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during June 1969 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given. Author (ESRO)

N70-13792*# TRW Systems Group, Houston, Tex. Control Systems Analysis Section.
LUMINARY 1B DAP PREFLIGHT PERFORMANCE EVALUATION
R. L. Haken and W. R. Hamel 13 Nov. 1969 161 p refs
(Contract NAS9-8166)
(NASA-CR-102019; TRW-11176-H394-R0-00) Avail: CFSTI CSCL 22B

The results of ten simulation runs comprising the LUMINARY 1B Digital Autopilot Software Verification and Performance Evaluation Testing for Mission H1 are presented. The testing program was for investigation and evaluation of the functions actually impacted by the DAP modifications from LUMINARY 1A. The reported tests were obtained from the all digital MSC Block 2 AGC bit-by-bit Simulation and the LUMINARY 1B, Rev. 116 flight program. The

initialization used in implementing the descent simulations places the spacecraft in a yaw attitude prior to DPS which requires the use of automatic windows-up maneuver in P63. The maneuver was removed from the flight plan of Apollo 12. It was observed during testing that the mass properties being used in the simulator environments are consistent with the latest issue of Section 6 of the GSOP, but the spacecraft mass properties in the simulator are different from those defined in the Spacecraft Operational Data Book for Apollo 12. To prevent mass mismatching between the LGC and the simulator environments, the DAP erasable load was adjusted to correlate with the simulator mass data. The effect of the mass adjustment did not substantially alter the DAP performance.
Author

N70-13804# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBAT WITH AIR AND SPACE TARGETS
P. V. Morozov 10 Jul. 1969 53 p refs Transl. into ENGLISH from the Russian
(AD-693484; FTD-HT-23-1465-68) Avail: CFSTI CSCL 15/3.1

This book is intended for a wide circle of readers in the Soviet army and navy. It is also useful for all wishing to become acquainted with the organization and problems of combat with modern systems of air and space attack. The book describes combat with modern air and space targets on land, in the air, and at sea, using modern means of antiaircraft and antispace defense. Attention is given to new strategic weapons. The book is based on foreign and Soviet open sources.
Author (TAB)

N70-13817# Air Force Academy, Colo. Frank J. Seiler Research Lab.
TIME-OPTIMAL ATTITUDE CONTROL OF AN AXIALLY SYMMETRIC SPINNING SPACECRAFT
Dirk H. De Does Jun. 1969 251 p refs
(AD-694483; SRL-69-0012) Avail: CFSTI CSCL 22/3

This report considers the problem of controlling both the attitude and angular velocities of an axially symmetric spacecraft while minimizing the maneuver duration. In particular, various combinations of thrust limited reaction jets are employed to properly orient a spinning space body with respect to specified reference directions starting from known initial conditions of the vehicles attitude and angular rates. Five control jet configurations are considered: two gimballed systems where torques can be applied about, (1) any axis in a plane normal to the axis of symmetry, (2) two perpendicular non-rotating axis in a plane normal to the axis of symmetry; and three body-fixed configurations where the thrusters are immobile relative to the vehicle and can provide both positive and negative or only positive (negative) control torques about one or both of the vehicles transverse axis. The control systems are realizable from a hardware standpoint and the corresponding optimal controls can be classified as: (1) a continuous function of time, (2) bang-bang, (3) on-off, and (4) a combination of (1 and 2) or (2 and 3).
Author (TAB)

N70-13845# European Space Research Organization, Paris (France).
PRELIMINARY STUDY FOR A WIDE-FIELD ASTRONOMICAL SATELLITE
L. Gratton Jul. 1968 36 p refs
(ESRO-SP-37) Avail: CFSTI

Following the recommendations of the STAR Group, a wide-field astronomical satellite has been studied with the following goals: a spectroscopic survey of as large a part of the sky as possible in the far UV and the mapping of the same region in two UV bands, including the Ly-alpha hydrogen line. For this experiment, the importance of which is comparable in scope to the Henry Draper Catalogue or the Palomar Sky Survey, preference has been given to the image-storage technique rather than the more traditional photographic recording. This choice almost completely determines the optics of the system insofar as the dimensions of the sensitive surface of an image-storage tube will only permit the use of a small telescope. It was therefore decided to use four Ritchey-Chretien telescopes (for direct image experiments) and five Schmidt-Wright cameras (for spectroscopic studies). The satellite would need to be stabilized along its three axes. A step-by-step scanning of the nine telescopes (in the anti-solar direction) would cover approximately one-third of the sky in the course of a year. An attitude drift of + or − 3 sec would give excellent scientific data. The amount of information to be expected from the spectroscopic experiments is the subject of the detailed mathematical appendix.
Author (ESRO)

N70-13869# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
SOME TECHNICAL FEATURES OF LOW ORBIT SATELLITES
C. Arduini, G. Buongiorno, U. Ponzi, and G. Ravelli Mar. 1969 34 p refs *Its* ATTI del Centro Ric. Aerospaziali No. 21
Avail: CFSTI

The present paper examines the main features and technical characteristics of low orbit scientific satellites, which are individualized by the fact that the aerodynamic effects are predominant and directly influence the design of the spacecraft. After a review of the main factors deriving from the environment and the most characteristic missions, the paper deals with problems associated with stabilization, aerodynamic characteristics and electronics.
Author (ESRO)

N70-13881# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, AUGUST 1969
R. D. Eberst 21 Oct. 1969 22 p
(ROE-STS-92) Avail: CFSTI

Stopwatch observations made at stations connected with the Section during August 1969 are listed in satellite launch order and in time order for each satellite. Various sub-totals are given.
Author (ESRO)

N70-13921# Oulu Univ. (Finland).
ON THE APPLICATION OF PERTURBATION TECHNIQUE TO THE STUDY OF MISSILE FLIGHT WITH SPECIAL REFERENCE TO INTERNAL MASS FLOW, THRUST MALALIGNMENTS, AND THE EFFECT OF GRAVITY
Matti A. Ranta 1969 43 p refs *Its* ACTA. Polytech. Scand., Mech. Eng. Ser. 43
(PB-185172; APS-ME-43) Avail: CFSTI; ACTA Polytech. Scand. Publishing Office, Stockholm, Box 5073. Sw. Kr. $10.00 CSCL 16D

For the stability of missiles in rectilinear flight with an arbitrary inclination, special attention is paid to some secondary factors usually neglected. They are the diminishing mass of the missile; the mass flow inside the missile; the imperfections in the resulting thrust called malalignments; and the effect of gravity. The treatment is based on the perturbation method applied to Euler's equations of motion, and on the Laplace transforms and the Wiener-Hopf technique. The stability criterion is derived from the approximate solution for small values of time. A numerical example is given.
Author (USGRDR)

N70-14040# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
ATTITUDE PERTURBATIONS OF A SPIN SATELLITE DUE TO GRAVITY-GRADIENT TORQUES IN A REGRESSING ORBIT
P. Ph. Van den Broek Aug. 1967 60 p refs
(VTH-145) Avail: CFSTI

This paper deals with the spin-axis drift of a spin-stabilized

satellite due to gravity-gradient torques. In general the orbit of a satellite rotates about the earth's polar axis, due to the oblateness of the earth. In this report the influence of this nodal regression on the spin-axis drift, due to gravity-gradient torques, is considered. The expressions for the spin-axis drift and the nodal regression are briefly discussed. An insight into the magnitude of the deviations of the spin-axis of a satellite in a regressing orbit is obtained by numerical computation of the behaviour of an hypothetical satellite. The results of the computations show that large deviations of the spin-axis may occur. However, for certain values of the orbital inclination the spin-axis drift, averaged over the period, in which the orbit plane rotates about the earth's axis, will vanish.
Author (ESRO)

N70-14051# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
THERMOELASTIC EFFECTS ON GRAVITY GRADIENT STABILIZED ARTIFICIAL SATELLITE [EFFETTI TERMOELASTICI NEI SATELLITI ARTIFICIALI STABILIZZATI A GRADIENTE DI GRAVITA]
Carlo Arduini and Giuliano Quozzo Aug. 1968 103 p refs In ITALIAN; ENGLISH summary *Its* ATTL del Centro Ric. Aerospaziali No. 18
Avail: CFSTI

Very long and flexible appendices or booms are commonly used aboard gravity stabilized satellites. These appendices are intended to increase the inertia moments about particular axes in order to get the stabilization of a predetermined direction with respect to the gravity field. The solar radiation induces thermoelastic flexural deformation of these structures thus influencing the stabilization characteristics. The present paper analyzes the temperature distribution inside these booms, the consequent thermal stresses and structural deformations. Static and dynamic changes in attitude due to the insolation are then analyzed and plots and diagrams concerning some typical cases are also included.
Author (ESRO)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-12723#
PROPAGATION OF ELASTIC-PLASTIC FLEXURAL AND SHEAR WAVES IN AXISYMMETRIC STRAINS OF SHELLS OF REVOLUTION [RASPROSTRANENIE UPRUGO-PLASTICHESKIKH VOLN IZGIBA I SDVIGA PRI OSESIMMETRICHNYKH DEFORMATSIYAKH OBOLOCHEK URASHCHENIYA]
M. P. Galin May 1969 60 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Inst. Mekhan. (USSR), v. 31, 1961 p 136 - 170
(PB-186084T; SCL-T-69-252) Avail: CFSTI CSCL 13M

Equations for the propagation of elastic-plastic waves in shells of revolution exhibiting axisymmetric strain are derived. The characteristics of the equations of motion are found, also the conditions on those characteristics. The problems in mathematical physics are formulated for a system of 3 quasi-linear hyperbolic-type second-order equations. The conditions for propagation of strong and weak discontinuities in the presence of elastic and elastic-plastic strains are investigated, and separately the elastic-plastic weak-discontinuity wave dividing the zones of elastic and elastic-plastic strains. Computational formulae are given for a dome being acted upon by an instantaneous impulse or external pressure that varies with time.
Author (USGRDR)

N70-12734*# Solar, San Diego, Calif.
OPTIMIZATION OF DUCT ASSEMBLIES FOR VIBRATION Quarterly Progress Report, 1 Jul. - 30 Sep. 1968
G. E. Bowie and W. A. Compton Huntsville, Ala. NASA. Marshall Space Flight Center Sep. 1968 92 p refs
(Contract NAS8-21128)
(NASA-CR-107143; RDR-1554-5; RP-6-2697-7; QPR-5) Avail: CFSTI CSCL 20K

The first three monthly reports include an extended analysis on duct systems in which damping mechanisms in duct sections and gimbal supports are treated in terms of equivalent viscous damper models. The theory is considered to be of general value in predicting mode shapes and stresses in components of duct systems. However, experimental results on the response of duct sections with inelastic damping sleeves demonstrated a need for a new theoretical approach which considers the detailed geometry and material properties of composite ducts. In the new method, the damping ratio for a composite duct is defined as a ratio of two volume integrals, with the numerator a function of unit material damping and the denominator a function of maximum elastic energy per cycle in the duct. This theory is described in detail in a proposal document. All of the planned response and fatigue life tests have been performed. Fabrication procedures and test data are reviewed in this report.
Author

N70-12735*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BUCKLING OF STIFFENED CYLINDERS IN AXIAL COMPRESSION AND BENDING: A REVIEW OF TEST DATA
James P. Peterson Washington Dec. 1969 27 p refs
(NASA-TN-D-5561; L-6767) Avail: CFSTI CSCL 20K

Test data on stiffened cylinders which failed by general instability under uniform axial compression and/or bending are reviewed, and the adequacy of contemporary methods for predicting buckling are appraised by comparing test data with results obtained from a contemporary buckling theory. Buckling failures of well-constructed cylinders with + or - 45 deg waffle stiffening were experienced at loads as low as 65 percent of the loads calculated for the cylinders, and other cylinders of different construction failed at loads approaching the 65-percent value. The latter cylinders include both isotropic and corrugated cylinders with ring stiffening, the only other types of construction for which much test data are available. Hence, testing to date has not revealed any type of stiffened cylinder construction that fails by general instability but is immune to low failing loads, and design methods which neglect the disparity between theory and test are likely to be unconservative.
Author

N70-12787*# Barry Wright Corp., Watertown, Mass.
STUDY OF ACTIVE VIBRATION ISOLATION SYSTEMS FOR SEVERE GROUND TRANSPORTATION ENVIRONMENTS
Peter C. Calcaterra, Richard D. Cavanaugh, and Dale W. Schubert Washington NASA Nov. 1969 160 p refs
(Contract NAS1-8611)
(NASA-CR-1454) Avail: CFSTI CSCL 20K

An investigation is conducted to evaluate the application of active mechanisms for the protection of equipment and/or personnel from the severe dynamic inputs characteristic of ground transportation vehicles. For the purposes of the study, dynamic loads and isolation system performance are defined in terms of the maximum expected vertical excitations associated with the suspension system of high speed ground transportation vehicles, and conservative levels of allowable passenger acceleration. The results indicate that the selected active isolation systems are capable of protecting a range of payloads from severe vibratory and transient dynamic loads. System stability, estimates of flow and power requirements, system weight, reliability, and failsafe criteria considerations are shown. Recommendations are made regarding extension of the techniques to provide isolation in the combined vertical and lateral directions.
Author

N70-12832# Sandia Corp., Albuquerque, N.Mex.
EFFECT OF STRAIN HARDENING AND STRAIN RATE IN ELASTIC-PLASTIC WAVE PROPAGATION
Walter Hermann and D. S. Mason 1969 43 p refs Presented at Nucl. Survivability Working Group on Propulsion and Ordnance Systems, Kirtland AFB, N.Mex., 3-4 Dec. 1969 Sponsored by AEC
(PB-186081; SC-DC-69-1964) Avail: CFSTI CSCL 11E

Observations have raised the question of the importance of anisotropic strain hardening and strain rate effects, particularly in applications involving the propagation of thin stress pulses. Moreover, if these effects are found to be significant, then the question arises as to how the constitutive functions are to be evaluated from equation of state experiments. Finally, since the inclusion of strain rate changes the character of the governing differential equations, the question arises as to how strain rate effects are to be accommodated in numerical integration methods. The present paper discusses some of these problems with particular reference to 6061-T6 aluminum, for which a large amount of excellent experimental data has accumulated. USGRDR

N70-12838# Argonne National Lab., Ill.
STRENGTH-DEFORMATION CONSIDERATIONS OF AN INVOLUTE SHELL
A. H. Marchertas Apr. 1969 43 p refs
(Contract W-31-109-eng-38)
(ANL-7493) Avail: CFSTI

An exploratory analysis is made of the behavior of a thin, cylindrical, involute shell subjected to a steady state pressure and internal thermal gradients (which vary along the involute). Five theoretical approaches are adapted to the one variable, involute shell problem, and solved explicitly for the dependent variables of internal loads and displacements. Small deflection theory is used throughout. Each approach was used to solve two numerical problems, one involving uniform transverse pressure imposed on the shell, and the other subjecting it to isothermal expansion. In both problems, three boundary conditions were employed: fixed, pinned, and what is referred to as rotated edges. Quantitative differences between the respective solutions are discussed. Similar comparisons are made with available experimental data. Author (NSA)

N70-12842# Sandia Corp., Livermore, Calif.
Aero-Thermodynamics Div.
NUMERICAL-COMPUTATIONS OF THE PLANE STRESS INTENSITY FACTORS FOR HOLLOW CYLINDERS UNDER TORSION, FLEXURE AND PRESSURE
A. Emery Jul. 1969 44 p refs
(Contract AT(29-1)-789)
(SCL-DR-69-59) Avail: CFSTI

The solution of the states of stress in hollow cylinders which are subject to torsion, flexure, and pressurization is studied. The cylinders are taken to be infinite in extent with cracks parallel to the generating axis and extending the full length of the cylinder. Both the states of stress and the stress intensity factors are determined numerically by the method of Emery and Segedin. It is shown that the stress intensity factors for the pressurized hollow cylinder are bounded by the valves for equivalent centrally cracked and edge cracked rectangular plates and that the valves for torsion and flexure may be correlated through normalizing by the maximum shear stress and the cylinder thickness. Author (NSA)

N70-12881# Sandia Corp., Albuquerque, N.Mex. Aerospace Nuclear Safety Dept.
EXPERIMENTALLY DETERMINED DYNAMIC SHEAR STRENGTH FOR SELECTED MATERIALS: GUN TEST FACILITY
J. H. Biffle and R. E. Berry Aug. 1969 24 p Sponsored by AEC
(SC-DR-69-491) Avail: CFSTI

Cylindrical projectiles were impacted on selected materials to permit the calculation of the materials dynamic shear strengths. The materials were beryllium, Haynes-25 alloy, and titanium (6Al-4V) alloy which are the materials of construction for the SNAP-27 graphite lunar module fuel cask and fuel capsule assembly. Author (NSA)

N70-12884# Bettis Atomic Power Lab., Pittsburgh, Pa.
GAPL-3: COMPUTER PROGRAM FOR THE INELASTIC LARGE-DEFLECTION STRESS ANALYSIS OF A THIN PLATE OR AXIALLY SYMMETRIC SHELLS WITH PRESSURE LOADING AND DEFLECTION RESTRAINTS
A. L. Thurman Jun. 1969 83 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-791) Avail: CFSTI

GAPL-3 is a computer program which performs an elastic – plastic, large-deflection analysis of thin plates and axisymmetric shells with pressure loading and deflection restraints. The solution is obtained by a discrete element method employing a double layer of elements to facilitate approximation of the inelastic stress state. The program is written in FORTRAN 4 for the CDC-6600 computer. Author (NSA)

N70-12930*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATLAS LAUNCHER TEST REPORT
R. T. Barrett Nov. 1969 37 p
(NASA-TM-X-52709) Avail: CFSTI CSCL 20K

A series of static, cyclic and failure tests were performed on components of an Atlas rocket vehicle launcher to verify the capability of the launcher to accept the launch loads expected with the uprated Atlas SLV-3C vehicle. The A-frame was subjected to both static and cyclic limit "down" loads by applying the test load to auxiliary support pins. The A-frame successfully passed the cyclic and static ultimate load tests; a subsequent failure test then resulted in excessive deflection of the A-frame pin at 214% limit load. The end-frame was subjected to both "up" and "down" static limit load and cyclic limit load tests. Load was applied to the end-frames through the support arm mechanism (head) by applying the test load to the main support pins. The end-frame withstood all test loads through ultimate load with no failures. Inspection following these tests revealed that yielding had taken place in some areas of the end-frame. Two new launcher frame cracks and three extensions of existing cracks resulted from this end-frame test program. Author

N70-12953# Sandia Corp., Albuquerque, N.Mex.
DYNAMIC LOADING OF A CYLINDRICAL SHELL
David J. Chavez and Donald S. Mason Sep. 1969 41 p refs Sponsored by AEC
(PB-186083; SC-RR-68-493) Avail: CFSTI CSCL 11G

This report describes a method to determine the asymmetric dynamic response of an infinite cylinder to an impulsive load. The equations account for rotational inertia and transverse shear. A computer program to implement the solution is included. Author (USGRDR)

N70-13008# Materials Research Lab., Inc., Glenwood, Ill.
DEVELOPMENT OF TEST PROCEDURES. FRACTURE TOUGHNESS OF REACTOR PRESSURE VESSEL STEELS Final Report
P. B. Crosley and E. J. Ripling Mar. 1969 43 p refs
(Contract AT(11-1)-1477)
(COO-1477-11) Avail: CFSTI

The effect of loading rate on fracture toughness of A533 steel was studied. Dynamic loading was found to elevate the yield strength to an extent that resulted in a significant decrease in the specimen size required for measuring valid plane strain toughness. The direct influence of rate on K sub Ic, however, was modest. The minimum specimen dimensions suggested by the ASTM E-24

Committee for high strength metal appears to be too conservative for this intermediate strength steel. Dimensions less than half the recommended ones were able to separate size-dependent from size-independent toughness values. The effect of specimen thickness at each of the testing temperatures could be described by the Irwin K sub Ic – K sub c – Beta sub c relationship. Using this expression, a K sub Ic value for infinitely thick specimens was defined, and this value was consistent with the lower bound of arrest toughness for tests made at +75, 0, and −75 F. Author (NSA)

N70-13017# Scientific Translation Service, Ann Arbor, Mich.
THEORY OF AN EXPERIMENTAL METHOD OF STRESS DETERMINATION REQUIRING NO ACCURATE KNOWLEDGE OF THE MODULUS OF ELASTICITY
A. Coutinho 1969 26 p refs Transl. into ENGLISH from French Publ. Sponsored by AEC Prepared for ORNL
(PB-186078T; ORNL-TR-2121) Avail: CFSTI CSCL 11B

The difficulties of knowing the exact modulus of elasticity of concrete are presented. It is due to these difficulties that it is not possible, in testing concrete structures, to obtain an exact knowledge of the stresses. In order to avoid this inaccuracy the author proposes a new method – – the inclusion method – – for determining stresses in solids whose moduli of elasticity are not well known. In this method an inclusion of a material with well-defined elastic constants (a metal, for instance) is inserted at the point where a knowledge of stresses is desired. The modulus of elasticity of the material of the inclusion must be 3, 4 or more times greater than that of the solid. Spherical, circular or cylindrical inclusions can be used in three, two or one-dimensional fields of stresses. Author (USGRDR)

N70-13044# General Electric Co., Pleasanton, Calif. Vallecitos Nuclear Center.
IMPACT TESTS AND FRACTURE TOUGHNESS
M. B. Reynolds May 1969 10 p refs
(Contract AT(04-3)-189)
(PB-186077; GEAP-5775) Avail: CFSTI CSCL 18F

The problems met in attempting to apply linear elastic fracture mechanics to moderately tough materials in thin sections are discussed. The possibility of using impact tests to estimate the toughness of such materials is suggested and the test conditions which must be met are listed. Author (USGRDR)

N70-13045# Sandia Corp., Albuquerque, N. Mex.
BEHAVIOR OF A BI-MATERIAL CYLINDER INCLUDING THE EFFECTS OF FRACTURE
Roy L. Johnson, Jr. Aug. 1969 65 p refs Prepared in cooperation with New Mexico Univ., Albuquerque, N. Mex.
(PB-186062; CE-16(69)S-093-2) Avail: CFSTI CSCL 13M

A finite element method is presented which utilizes a three dimensional quadrilateral finite element with a stiffness matrix developed in cylindrical coordinates. The method is used to study the behavior of layered cylinders due to asymmetric static thermal loadings. Two types of bonding, rigid and flexible are considered. Additional examples including a pressurized thick walled cylinder and a cylindrical shell under pressure and thermal loadings are presented. Author (USGRDR)

N70-13093*# Michigan Univ., Ann Arbor.
VERTICAL AND LATERAL STIFFNESS CHARACTERISTICS OF AIRCRAFT TIRES
G. H. Nybakken and S. K. Clark Washington NASA Dec. 1969 22 p refs
(Grant NGR-23-005-010)
(NASA-CR-1488; TR-8) Avail: CFSTI CSCL 20K

This report presents methods for estimating both vertical and lateral stiffness characteristics of pneumatic tires, and compares such predictions with a large amount of existing experimental data which has been collected from various sources. Author

N70-13112# Naval Research Lab., Washington, D.C. Shock and Vibration Information Center.
THE SHOCK AND VIBRATION BULLETIN, NO. 39, PART 5
Dec. 1968 102 p refs Proc. of the 39th Symp. on Shock and Vibration, Pacific Grove, Calif., 22-24 Oct. 1968
(AD-684066) Avail: CFSTI CSCL 20/11

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N70-13113# Martin Co., Orlando, Fla. Structures and Mechanics Dept.
DYNAMIC RESPONSE OF A SINGLE-DEGREE-OF-FREEDOM ELASTIC-PLASTIC SYSTEM SUBJECTED TO A SAWTOOTH PULSE
Martin Wohltman *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 1–12 refs (See N70-13112 03-32)
Avail: CFSTI

The dynamic response of a single-degree-of-freedom system subjected to a sawtooth pulse, where the resistance function is elastic-plastic, has been analyzed. Maximum displacement, time to maximum displacement and work done are the response quantities computed. Results are presented in design charts in nondimensional form as a function of two parametric ratios. A comparison of dynamic response for the elastic-plastic versus the rigid-plastic idealization is made. A numerical example is included. Author

N70-13114# Boeing Co., Seattle, Wash.
TRANSIENT DYNAMIC RESPONSES IN ELASTIC MEDIUM GENERATED BY SUDDENLY APPLIED FORCE
James Chi-Dian Go *In* NRL Shock and Vibration Bull., no. 39, pt.

5 Dec. 1968 p 13–19 refs (See N70-13112 03-32)
Avail: CFSTI

The problem of wave propagation in an elastic half-space, subjected to a suddenly applied force on its free surface, is considered. The initial boundary value problem is formulated in the form of two wave equations, namely the dilatational and shear-wave equations. The dynamic responses, such as stress waves, particle velocity, and acceleration, are expressed in terms of the two wave functions and their derivatives. These two wave equations together with the initial boundary conditions are transformed by Laplace and Hankel integral transformations. Consequently, the problem is governed by two Helmholtz's equations that are independent of time. Transform solutions of the Helmholtz's equations, which also satisfied the transformed boundary conditions, were obtained by separation of variables and infinite integration in a complex plane. These transform solutions were inverted into the time domain by indirect inversion technique, which consists of a series of functional transformations and contour integrations. Author

N70-13115# Hittman Associates, Inc., Columbia, Md.
IMPACT FAILURE CRITERION FOR CYLINDRICAL AND SPHERICAL SHELLS
Donald F. Haskell *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 21–27 refs (See N70-13112 03-32)
Avail: CFSTI

A failure criterion was developed for high velocity axial impact of cylindrical shells and normal impact of spherical shells. This criterion includes all the structural and material parameters which appear to affect shell impact response and is based upon a relatively simple analysis of the shell impact phenomena. It is applicable to thick and thin shells over a wide range of radius-to-thickness ratios. Since the criterion includes both structural and material parameters in its formation, it may be employed to predict failure velocities, or shell wall thickness, for shells fabricated from various materials. Author

N70-13116# Lockheed Missiles and Space Co., Palo Alto, Calif.
THE EXCITATION OF SPHERICAL OBJECTS BY THE PASSAGE OF PRESSURE WAVES
Gordon E. Strickland, Jr. *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 29–40 refs (See N70-13112 03-32)
Avail: CFSTI

A series solution is derived for the pressure experienced by a sphere during and after the passage of a step pressure wave of small amplitude. This solution converges too slowly to yield the pressure field explicitly. However, from this solution explicit results can be obtained for the total force exerted on a hemispherical dome during the passage of the wave. Such results are presented for the horizontal and vertical components of the force exerted on a hemispherical dome during the passage of a horizontally progressing wave, and also for the axial force experienced by a dome subjected to a descending wave. Author

N70-13117# Sandia Corp., Albuquerque, N.Mex.
THE PERFORMANCE CHARACTERISTICS OF CONCENTRATED-CHARGE, EXPLOSIVE-DRIVEN SHOCK TUBES
L. W. Bickle and M. G. Vigil *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 41–52 refs (See N70-13112 03-32)
Avail: CFSTI

This paper reviews a scaling theory which is applicable to concentrated charge, explosive driven shock tubes and presents experimental performance data verifying this theory. The scaled experimental performance data is compared with theoretical performance data generated by WONDY, a hydrodynamic computer code, for some cases of practical interest. An example of how the scaled experimental data can be used as a calibration of concentrated charge, explosive driven shock tubes is included. Author

N70-13119# Ling-Temco-Vought, Inc., Anaheim, Calif. Research Center.
ZERO IMPEDANCE SHOCK TESTS: A CASE FOR SPECIFYING THE MACHINE
Charles T. Morrow *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 63–66 refs (See N70-13112 03-32)
Avail: CFSTI

An appraisal of factors involved in the potential application of zero mechanical impedance or force controlled vibration in shock testing. It appears that such a development will substitute the design of a vibration or shock isolator for the usual fixture design problem and may bring about a test philosophy closer to specifying the test machine than to the direct specification of an applied spectrum or pulse. Author

N70-13120# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SHOCK TESTING WITH AN ELECTRODYNAMIC EXCITER AND WAVEFORM SYNTHESIZER
Dana A. Regillo *In* NRL Shock and Vibration Bull., no. 39, pt. 5 Dec. 1968 p 67–72 refs Sponsored by USAF (See N70-13122 03-32)
Avail: CFSTI

A description is given of the method used to meet a shock spectrum requirement for a spacecraft and its components. The size of the spacecraft and the stringent requirements of the shock spectrum eliminated the consideration of conventional drop tables. Consequently, an electrodynamic exciter, pulsed by a waveform synthesizer, was used to shock all three axes of the spacecraft bidirectionally (and its components separately). It illustrates by examples of input and output data, the relationship between the results and the inputs required to achieve those results. Author

N70-13241# University Coll., Cork (Ireland). Dept. of Mathematical Physics.
POLYGONAL AND SWEPT-BACK PLATES WITH CUT-OUTS AND COLUMN SUPPORTS
P. M. Quinlan Nov. 1968 81 p refs Presented at the OAR Research Appl. Conf., Washington, D.C., Mar. 1968
(Grant AF-EOAR-31-67)
(AD-678212; AFOSR-68-2612) Avail: CFSTI CSCL 13/13

A general computer method is presented of solving a very wide range of swept-back wing and skew bridge problems with any boundary conditions and loadings, with or without any number of cut-outs and elastic column supports. New computer formulae, or algorithms, are established for polar and symmetrical edge-function biharmonics and these provide an extraordinarily rich source of complementary functions for adjusting to any prescribed boundary conditions. A single computer program caters for all cases, the only inputs being a coded specification of the boundary conditions, locations for loading and columns, and a subroutine to give the plate-shape. Author (TAB)

N70-13277*# Southwest Research Inst., San Antonio, Tex.
RESPONSE OF A CYLINDRICAL SHELL TO RANDOM ACOUSTIC EXCITATION Interim Report
Daniel D. Kana 15 Jul. 1969 41 p refs
(Contract NAS8-21479; SwRI Proj. 02-2396)
(NASA-CR-102296) Avail: CFSTI CSCL 20K

Response and equivalent force spectra have been investigated for random acoustic excitation of a cylindrical shell within a frequency band of relatively low modal density. Theoretical and experimental results are compared for single point transfer functions

acoustic mobility functions, response and equivalent force power spectral densities, and coherence functions. In general, it is found that a purely theoretical prediction of response based on linear random process theory is severely limited because of the inability of currently available expressions for transfer functions to account for various deviations which result principally from imperfections and eccentricities in the cylinder. However, good agreement is achieved between measured response and that calculated that with measured transfer functions. It is further indicated that a rather coarse discrete representation of a continuously distributed excitation is possible. Author

N70-13364# California Univ., Berkeley.
A BRIEF DESCRIPTION OF A METHOD FOR THE ACCELERATION CONTROL OF VARIABLE PARAMETER, OSCILLATORY LOADS
Peter W. Rodgers and Yasundo Takahashi 1969 12 p
(Grant NSF GK-1319)
(PB-185187) Avail: CFSTI CSCL 13M

The structure, which is generally underdamped, is mounted on a shaking table. The table is then driven so that its acceleration follows as closely as possible a commanded acceleration, which may be patterned after that produced by an earthquake. It is to be expected that parameters of the structure will change as the test proceeds toward structural failure. There are two problems which make the control of acceleration in the presence of such a load difficult: the load parameters are not constants; and because the load is oscillatory and may be lightly damped, it may be expected that conventional, non-adaptive control systems will exhibit poor control of acceleration at the resonant frequency of the load. Author (USGRDR)

N70-13389# British Steel Corp., London (England). Metallurgy Div.
THE EFFECT OF POSITION OF MEASUREMENT ON CRACK OPENING DISPLACEMENT
D. Elliot and M. J. May 1969 13 p refs
(PB-185932; MB/C/47/69) Avail: CFSTI CSCL 20K

The report emphasises the need for an experimental method of obtaining the crack tip crack opening displacement (C.O.D.) from measurements made remote from the crack tip location. In particular, a method is described whereby clip gauge displacements can be converted to the crack tip C.O.D. from a prior knowledge of displacement magnification and rotational effects for specimens of different notch depths. The effects of crack extension and the influence of triaxial stresses are also discussed. Author (USGRDR)

N70-13390# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENERAL SOLUTION OF THE TWO-DIMENSIONAL THEORY OF ELASTICITY FOR AN ORTHOTROPIC RECTANGULAR PLATE
Yu. P. Kochanov 19 May 1969 11 p refs Transl. into ENGLISH from Sudostroenie i Morsk. Sooruzheniya (USSR), no. 6, 1967 p 11-16
(AD-694399; FTD-HT-23-156-69) Avail: CFSTI CSCL 13/10

A single form of the solution of the two-dimensional problem of stresses for orthotropic rectangular plates is constructed. Unlike other solutions, it is applicable under general boundary conditions at the contour of the plate. It is assumed that body forces are absent and that the principal directions of the plate coincide with the Ox and Oy axes. The usual equations are used for the two-dimensional stressed state. The solution of the first boundary value problem of elasticity theory is used as an illustration. Formulas are obtained that allow the unknown coefficients to be determined as functions of the known coefficients of Fourier series for the external forces at the contour of the plate. The formulas allow complete solution of the first boundary value problem. The second boundary problem and diverse mixed problems can be reduced to solution of infinite systems of linear algebraic equations. Author (TAB)

N70-13393# British Steel Corp., London (England). Metallurgy Div.
FRACTURE TOUGHNESS TESTING IN IMPACT
A. H. Priest and M. J. May 1969 28 p
(PB-185933; MG/C/46/69) Avail: CFSTI CSCL 20K

The report deals with the measurement of plane strain fracture toughness (Ksubic) in impact tests where inertial load effects influence load measurements derived from instrumentation of the tup and anvil of the testing machine. Load measurements were determined using post yield strain gauges attached across the specimen notch and it was found that the load on the specimen during the impact test is a simple function of the compliance of the specimen, the test machine and the impact velocity. In order to calculate the fracture load it is necessary to determine accurately the instant at which fracture initiates and this has been possible by monitoring voltage changes occurring in the plastic zone at the crack tip. Author (USGRDR)

N70-13407*# Ohio State Univ., Columbus.
FLUTTER OF THERMALLY STRESSED PLATES AT HYPERSONIC SPEEDS Interim Report For Period Ending 30 Jun. 1969
[1969] 33 p refs
(Grant NGR-36-008-109)
(NASA-CR-107210) Avail: CFSTI CSCL 20K

Approximate solutions to the thermal stress problem with mixed boundary conditions were investigated including: (1) complementary energy, (2) complementary energy with constraints, (3) collocation with constraints, and (4) point matching. The complementary energy method was selected for the project thermal stress determinations. Comparative data were obtained from existing solutions by finite differences for a uniform temperature increase, and by a matrix finite element displacement solution for an experimentally measured temperature distribution and for stresses from measured strains for the same experimental temperature distribution. The results for the stresses in a free plate under a parabolic temperature distribution were compared. A project-related paper on modal coupling in thermally stressed plates is appended in which it is shown that the coupled dynamic response of thermally stressed plates depend primarily upon two factors: (1) the thermal buckling eigenvalues (critical thermal loading) of the idealized perfect plate and, (2) the initial deformation of the mid-plane of the real plate. J.A.M.

N70-13556# Massachusetts Inst. of Tech., Cambridge.
SHEAR FRACTURE IN ZIRCONIUM AND ITS ALLOYS Technical Progress Report
John A. Jensen, Jr. and Walter A. Backofen Aug. 1969 6 p ref
(Contract AT(30-1)-3635)
(MIT-3635-4) Avail: CFSTI

Results of an investigation of plain-strain deformation in Zircaloy-4 are presented. Basic flow properties and their temperature dependence were also studied by tensile testing. Results are discussed and summarized graphically. Author (NSA)

N70-13571# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE INITIATION AND EXTENT OF DUCTILE PIPE RUPTURE, PHASE 1 Final Report
Robert J. Eiber, Willard A. Maxey, Arthur R. Duffy, and Thomas J. Atterbury Jul. 1969 112 p refs
(Contract W-7405-eng-92)
(BMI-1866) Avail: CFSTI

Analytical expressions to predict critical flaw sizes in A106B carbon steel and Type 316 stainless steel pipe were formulated and then evaluated with the experimental results obtained from investigation of representative primary-coolant reactor piping materials under simulated reactor conditions. The analytical expressions were found to accurately predict critical flaw sizes. It was determined that the flow stress values can be obtained from tensile tests of the material at the service temperature; this permits critical crack sizes to be predicted in piping on the basis of the vessel geometry and tensile tests of the material. Three modes of failure were identified as leaks, short crack extensions, and ruptures. The conditions governing the failures were also defined, permitting the mode of failure to be predicted. Information was also obtained on the speeds of fractures under simulated reactor conditions and the rupture areas developed. Author (NSA)

N70-13609# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRESSED STATE OF AN ORTHOTROPIC PLATE

V. P. Lozbinev 13 May 1969 9 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), No. 9, 1966 p 45–48

(AD-693952; FTD-HT-23-198-69) Avail: CFSTI CSCL 13/13

The author solves the plane problem from the theory of elasticity for the stressed state of a rectangular orthotropic plate using a simple method for determining the constants of integration applicable to an isotropic plate. The constants of integration are found directly as coefficients of the Fourier expansion for the edge load, assuming that the plate is subjected to arbitrary normal and tangential forces with respect to the long sides. Experimental and theoretical stresses are compared for a plate made from fiberglass-reinforced plastic and for a corrugated plate with shallow corrugations. The results show satisfactory agreement which indicates that the proposed method is applicable to problems of this type and should result in a considerable reduction of time and labor in solving complex contact problems. TAB

N70-13621# Naval Research Lab., Washington, D.C. Shock and Vibration Information Center.

THE SHOCK AND VIBRATION BULLETIN 39, PART 3

Jan. 1969 253 p refs Proc. of the 39th Symp. on Shock and Vibration, Pacific Grove, Calif., 22–24 Oct. 1968

(AD-684065) Avail: CFSTI CSCL 20/11

Various methods of dynamic structural analyses are performed and compared with vibration measurement data obtained on a wide range of materials and structures. Emphasis is placed on shock load effects and vibrational frequencies. For individual studies see N70-13621 through N70-13644.

N70-13622# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MODAL DENSITIES OF SANDWICH PANELS: THEORY AND EXPERIMENT

Larry L. Erickson *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 1–16 refs (See N70-13621 03-32)

Avail: CFSTI

Formulas are presented that can be used to estimate the average modal densities of sandwich beams and flat or cylindrically curved sandwich panels. Numerical results, presented in terms of general parameters, indicate the relative importance of transverse shear flexibility, orthotropic shear moduli of the core, face-bending stiffness, rotary inertia, and panel curvature over a wide frequency range. Modal densities determined experimentally from resonance tests of flat rectangular sandwich panels having orthotropic cores are close to the modal densities estimated by theory except at frequencies near that of the fundamental mode. In this low-frequency range, the theoretical estimates are not valid. Author

N70-13624# Brigham Young Univ., Provo, Utah. Dept. of Civil Engineering Science.

SYNTHESIS OF RIGID FRAMES BASED ON DYNAMIC CRITERIA

Henry N. Christiansen and E. Alan Pettit, Jr. (Humble Oil Co., Benicia, Calif.) *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 31–38 refs (See N70-13621 03-32)

Avail: CFSTI

This paper describes the development of an automated structural design procedure for sizing the members of three-dimensional rigid-joint frames subject to resonant frequency requirements. The procedure seeks a minimum cost structure for which the lowest natural frequency is specified. The development includes a mathematical formulation of the problem, the organization of an iterative design procedure, and the presentation of an example problem. Author

N70-13625# KPA Computer Techniques, Inc., Pittsburgh, Pa.

DYNAMIC RESPONSE OF PLASTIC AND METAL SPIDER BEAMS FOR 1/9th SCALE SATURN MODEL

L. V. Kulasa and W. M. Laird (New York Univ., Fredonia) *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 39–47 refs (See N70-13621 03-32)

Avail: CFSTI

Plastic and metal spider beams for a 1/9th scale Saturn model were vibration tested in a simulated free–free condition, to determine the vibration characteristics and to demonstrate the advantages of using plastics for dynamic model testing. Frequencies were measured by using accelerometers bonded to the beam and to the electrodynamic shaker which provided the vibratory excitation. Mode shapes were visually observed with a stroboscope and were recorded using a Fastax camera operating at approximately 2,000 frames per second. Author

N70-13626*# Lockheed-Georgia Co., Marietta. Aerospace Sciences Research Lab.

CHARTS FOR ESTIMATING THE EFFECT OF SHEAR DEFORMATION AND ROTARY INERTIA ON THE NATURAL FREQUENCIES OF UNIFORM BEAMS

F. F. Rudder, Jr. *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 49–54 refs (See N70-13621 03-32)

Avail: CFSTI

The effect of shear deformation and rotary inertia on the natural frequencies of a uniform beam are presented in the form of design charts. These charts represent the eigenvalues obtained using Timoshenko beam theory for several sets of boundary conditions of interest to engineers. In particular, the charts illustrate the manner in which the theory asymptotically approaches elementary beam theory. Author

N70-13627*# Martin Marietta Corp., Denver, Colo.

ACOUSTIC RESPONSE ANALYSIS OF LARGE STRUCTURES

F. A. Smith and R. E. Jewell (NASA, Marshall Space Flight Center) *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 55–64 refs (See N70-13621 03-32)

Avail: CFSTI

Following is a summary of the technical approach and the results of an acoustic response analysis performed on a large complex payload. The purpose of the analysis was to evaluate the feasibility of calculating the acoustic response of complex structures to at least 200 Hz including considerations of the structural properties of the payload. The technical approach used to obtain the modal representation of the payload and the payload configuration is presented. Because of the required frequency response of the complex structure, the final model used in the response analysis represents over 3,000 degrees of freedom. The method for applying the acoustic pressures is discussed as well as the results of the analysis. Author

N70-13628# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ESTIMATION OF PROBABILITY OF STRUCTURAL DAMAGE FROM COMBINED BLAST AND FINITE-DURATION ACOUSTIC LOADING
Eric E. Ungar and Yoram Kadman *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 65–71 refs (See N70-13621 03-32)
Avail: CFSTI

Results are summarized that permit one to estimate the probability that the response of a structure to random acoustic excitation will exceed a specified level during a time interval of given duration. Characteristics of responses to explosion pressure-pulses are described in simplified terms. Means are presented for obtaining engineering estimates of the probability that the response of a structure to a pressure pulse, which occurs at a given time during the action of the acoustic excitation, will exceed a prescribed value. Author

N70-13629# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
THE RESPONSE OF MECHANICAL SYSTEMS TO BANDS OF RANDOM EXCITATION
L. J. Pulgrano and M. Ablowitz *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 73–86 refs (See N70-13621 03-32)
Avail: CFSTI

The mean square response of a single-degree-of-freedom system has been determined for both band-limited white noise excitation and a band of excitation having a constant db/octave change in level. Solutions are given for those input-output combinations that are of greatest interest, such as force or acceleration excitations and acceleration or displacement responses. The results include exact analytical expressions for all cases, and both approximate expressions and graphical presentations for use in making quick calculations in most practical cases. Author

N70-13630# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
PREDICTION OF STRESS AND FATIGUE LIFE OF ACOUSTICALLY-EXCITED AIRCRAFT STRUCTURES
Noe Arcas *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 87–97 refs (See N70-13621 03-32)
Avail: CFSTI

A technique for predicting stress on aircraft structure excited by high intensity noise is extended in several areas: (1) modal functions which provide improved boundary conditions are used; (2) further data is included in the comparison of theory and experiment; (3) statistical confidence limits are obtained for the predicted stresses; and (4) fatigue life predictions are made and the results are compared with experimental data. Author

N70-13631# Colorado Univ., Boulder.
VIBRATION ANALYSIS OF COMPLEX STRUCTURAL SYSTEMS BY MODAL SUBSTITUTION
R. L. Bajan, C. C. Feng, and I. J. Jaszlics (Martin Marietta Corp., Denver) *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 99–105 refs (See N70-13621 03-32)
Avail: CFSTI

An improved analytical method for the vibration analysis of complex structural systems is presented. The structure is divided into several subsystems, each of which is represented by its normal modes of vibration. The vibration modes of the complete system are obtained by either partial, or full modal coupling of the subsystem modes. The salient feature of the present method is that the resulting eigenvalue problem is kept relatively small by introducing the subsystem modes into the analysis in sequential groups, rather than simultaneously as is usual in conventional vibration analyses. The system modes thus obtained are convergent to the modes obtained through conventional solution of the complete eigenvalue problem. A modal error contribution algorithm is developed to optimize the sequence of introduction of the subsystem modes into the analysis. A simple example is presented which shows the rapid convergence of the method. Author

N70-13632# Oklahoma Univ., Norman. School of Aerospace and Mechanical Engineering.
THE APPLICATION OF THE KENNEDY–PANCU METHOD TO EXPERIMENTAL VIBRATION STUDIES OF COMPLEX SHELL STRUCTURES
John D. Ray, Charles W. Bert, and Davis M. Egle *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 107–115 refs (See N70-13621 03-32)
Avail: CFSTI

The theoretical basis for the Kennedy–Pancu (K-P) technique is outlined briefly. This vibration data analysis technique, which uses both amplitude and phase data, is much more reliable than the usual amplitude method in separating nearly equal natural frequencies and extraneous modes from the pure resonant mode. Application of the K-P technique to two different kinds of shell structures is described. This is believed to be the first reported use of the technique for shell structures. The first example is a cylindrical shell with a small number of longitudinal stiffeners. The physical quantity used here for the K-P plot was the output of an electromagnetic velocity pickup. The second example is a truncated conical shell of sandwich construction, with glass-fiber reinforced plastic facings and an aluminum hexagonal honeycomb core. In this example, the quantity used in the K-P plot was the output of a metallic foil strain gage. Here the use of the K-P technique resulted in the discovery of a vibrational mode unidentified in previous research on free-free truncated conical shells. Author

N70-13633# Raytheon Co., Portsmouth, R.I. Submarine Signal Div.
NORMAL MODE STRUCTURAL ANALYSIS CALCULATIONS VERSUS RESULTS
Culver J. Floyd *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 117–128 refs (See N70-13621 03-32)
Avail: CFSTI

Acceleration data from the medium weight machine has been used as inputs to a computer-aided normal mode analysis for new sonar cabinet chassis design. The same data has been used as inputs to a more conventional hand calculation method. Cabinets and chassis analyzed by these two methods have now been tested. This paper compares the results of the two calculation methods. Author

N70-13634# Washington Univ., St. Louis, Mo. Dept. of Civil and Environmental Engineering.
COMPARISONS OF CONSISTENT MASS MATRIX SCHEMES
R. M. Mains *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 129–142 refs (See N70-13621 03-32)
Avail: CFSTI

It has become popular to use one or another "consistent" mass matrix scheme in dynamic analysis with finite elements. Such schemes have the claimed advantage of transferring to the computer some of the calculations previously done by hand, and of producing greater accuracy in the calculation of natural frequencies and mode shapes. These schemes have a distinct disadvantage in calculations because they produce non-diagonal mass matrices which require either: (1) two eigenvalue problems to be solved, one for the mass alone and one for the mass together with the stiffness; and (2) the eigenvalues of the unsymmetric product of KM must be solved. In either case computation time and complexity are at least doubled. In order to develop some judgement on whether the extra effort is worth-while or not, the author has compared the masses, frequencies, and mode shapes for 7 different versions of mass with the same stiffness for a cantilever beam. There seems to be little to gain from the consistent mass schemes. Author

N70-13635# Naval Research Lab., Washington, D.C.
MEASUREMENT OF A STRUCTURE'S MODAL EFFECTIVE MASS
G. J. O'Hara and G. M. Remmers *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 143–151 refs (See N70-13621 03-32)
Avail: CFSTI

An important parameter in the shock design and analysis of response of shipboard equipment is Modal Effective Mass. This paper describes the experimental determination of the modal effective masses of symmetric double cantilever beams when they are suspended by a long cable to simulate a free-free condition. Several special techniques and instrumentation modifications were employed to improve the measurements obtained so that a statistical best fit approach could be applied to find the first three modal effective masses. The partial differential beam equation including shear and rotary inertia was solved for approximate mode shapes by the Second Method of Ritz where advantage was taken of the experimentally determined fixed base natural frequencies. They were used to estimate the values of the first mode's effective mass for comparison with the measured value. The results obtained and reported show consistent agreement well within reasonably expected bounds of experimental and mathematical resolution. Author

N70-13636# Dynamic Science Corp., Monrovia, Calif.
SIMPLIFYING A LUMPED PARAMETER MODEL
Martin T. Soifer and Arlen W. Bell *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 153–160 refs (See N70-13621 03-32)
Avail: CFSTI

This work constitutes an extension of work previously presented by the authors. A method for simplifying a lumped parameter model by reducing the number of mass points is derived. Two degrees of freedom per mass point are allowed for, and the basis for the reduction procedure is that the work done on the reduced system is equal to the work done on the original system by the inertia forces during a free vibration. The procedure is applied to the in-plane deformation of a truss, and a dynamic equivalence between the reduced and original systems is established. Author

N70-13637# Polytechnic Inst. of Brooklyn, N.Y.
STEADY STATE BEHAVIOR OF TWO DEGREE OF FREEDOM NONLINEAR SYSTEMS
J. A. Padovan and J. R. Curreri *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 161–169 refs (See N70-13621 03-32)
Avail: CFSTI

The Ritz averaging method is used in obtaining approximate solutions to the response of a two degree of freedom nonlinear system. The general equations are derived for linear damping with cubic nonlinearities in both springs. Frequency response curves are plotted for various values of a hardening spring characteristic in either of the two springs. The response is shown for both masses. Similar to the single degree of freedom system, the two degree system has either 1, 2 or 3 solutions, not all of which are stable. A study of the nonlinear response curves make it easy to postulate the nature of the spring nonlinearities that would result in more simultaneous solutions. Author

N70-13638# University of Southern Calif., Los Angeles.
THE FLUTTER OR GALLOPING OF CERTAIN STRUCTURES IN A FLUID STREAM
Raymond C. Binder *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 171–178 refs (See N70-13621 03-32)
Avail: CFSTI

This paper presents a first-order analysis for one case that has not been presented in the literature. A two-degree-of-freedom system (torsion and translation) in a fluid stream is first analyzed for the general case. The basic equations of motion are set up and the characteristic equation found. The particular case is taken in which the center of gravity coincides with the elastic axis. There are indications that this case is involved in various applications. A closed form solution is obtained as a function of pertinent system parameters including approach fluid velocity. In a range of velocities the motion of the system is bounded and no dangerous torsional or translational displacement amplitude is involved. At one particular velocity, however, the characteristic roots are equal, and the vibration amplitude increases with time; this condition might be classed as a critical flutter or gallop. At this critical condition the flutter frequency equals the natural translation frequency. At a higher approach velocity the characteristic equation gives at least one positive root, which means an amplitude build-up, and an unstable condition. Author

N70-13640# Oklahoma Univ., Norman. School of Aerospace and Mechanical Engineering.
EXPERIMENTAL INVESTIGATION OF NONLINEAR VIBRATIONS OF LAMINATED ANISOTROPIC PANELS
Bryon L. Mayberry and Charles W. Bert *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 191–199 refs (See N70-13621 03-32)
Avail: CFSTI

Steady-state vibrational experiments were performed to determine experimentally the resonant frequencies of different clamped rectangular plates made of various composite-material laminates under large deflections. The panels were fabricated from a glass-fiber reinforced plastic consisting of glass fabric impregnated with epoxy. Base excitation of the rigid clamping fixture was accomplished with an electrodynamic shaker. Resonance was determined by the peak amplitude response of a small metallic-foil strain gage at the plate center and stroboscopic observation of a grid pattern on the plate surface was used for mode identification. As the exciting force (and thus the plate deflection) was increased, the resonance frequencies associated with the various vibrational modes increased. This indicated that the nonlinearity was a geometric one of the hardening-spring type, in qualitative agreement with various theoretical analyses of large-amplitude vibration of rectangular plates. Author

N70-13641# General Electric Co., Syracuse, N.Y.
STRUCTURAL DYNAMICS ANALYSIS OF AN ANISOTROPIC MATERIAL
S. K. Lee *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 201–204 refs (See N70-13621 03-32)
Avail: CFSTI

A theoretical study is presented on the propagation of a plane wave through an anisotropic material—a linear elastic material which is reinforced with parallel fibers in one direction. Other than the Young's modulus along the direction of the fiber, the property of the reinforced material is assumed to remain unchanged. Fourier method is used and the frequency equation, analytical expressions of the displacements, stresses are obtained. The numerical results can then be computed. This theoretical analysis may be used to improve the performance of systems incorporating a reinforcement member. Author

N70-13642# Syracuse Univ., N.Y. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTS ON THE LARGE AMPLITUDE PARAMETRIC RESPONSE OF RECTANGULAR PLATES UNDER IN-PLANE RANDOM LOADS
R. L. Silver and J. H. Somerset *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 205–231 refs (See N70-13621 03-32)
(Grants NSF GK-918; NSF GK-2868)
Avail: CFSTI

Experiments have been performed to determine the large amplitude lateral vibration of a simply supported rectangular plate subjected to a distributed in-plane load of a narrow band random process. Power spectral densities of load and response are obtained and the effects of transaction mechanisms are evaluated. Typical sample functions are obtained. An analysis is presented which shows that certain frequency shifts occur in the spectrum of the response, with the result that the mean frequency of the response is not an integral fraction of the load mean frequency, and the spectrum of the response is shifted along the frequency axis. The experimental results are compared to the theory presented in this paper and with analytical results previously obtained. The agreement between theory and experiment is good. Author

N70-13643# Schutte Mochon, Inc., Milwaukee, Wis.
RESPONSE OF STIFFENED PLATES TO MOVING SPRUNG MASS LOADS
Ganpat M. Singhvi and Larry J. Feeser (Colorado Univ.) *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 233–245 refs (See N70-13621 03-32)
Avail: CFSTI

An analytical procedure to predict the behavior of orthogonally stiffened plates subjected to a moving sprung mass system is developed. The loading considered consists of a damped spring borne mass supported by an unsprung wheel mass subjected to a pulsating driving force moving with a constant velocity in an arbitrary straight path across the plate. The general solution in the form of a triple infinite series is obtained to represent the dynamic deflection of a rectangular stiffened plate simply supported on all four sides. Numerical solutions obtaining dynamic deflections and dynamic bending moments at the center of the plate and under the load are presented for a rectangular stiffened plate and are compared with constant force and crawl load solutions. The results of the study indicate that the inertia of the moving mass has a significant effect upon the deflections and moments in stiffened plates and must be included to obtain good designs. Author

N70-13644# Colorado Univ., Boulder.
PARAMETRIC RESPONSE SPECTRA FOR IMPERFECT COLUMNS
Martin L. Moody *In* NRL The Shock and Vibration Bull. 39, Part 3 Jan. 1969 p 247–252 refs (See N70-13621 03-32)
Avail: CFSTI

Response spectra for the maximum amplitude of mid-span deflection for a simply supported column subjected to 20 cycles of harmonically vary-axial force are presented. The nonlinear effects of inertia and large deflections are included in the investigation, and typical linear steady state solutions are shown for comparison. Author

N70-13702# Technische Hogeschool, Delft (Netherlands).
AN EXTENSION OF THE VALIDITY OF BEAM THEORY BEYOND ITS CLASSICAL BOUNDS
A. van der Neut Apr. 1969 18 p
(VTH-154) Avail: CFSTI

It is shown that the classical solution for the shear flow distribution of prismatic shell structures with rigid frames is not only valid for constant shear and torque loads, but also for linearly varying shear and torque. In addition to the linear bending stress distribution normal stresses occur, which derive from the axial variation of warping. Numerical examples show that although these additional stresses are small, their distribution is similar to the distribution of shear lag stresses but they have opposite sign. This result means that the engineering method of applying elementary beam theory to shell structures where the lateral load is far from constant, is much more accurate than usually considered. This conclusion can be extended to tapered shells for those designed for constant strength. Author (ESRO)

N70-13720# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
THE LONGITUDINAL STIFFNESS OF SIMPLY SUPPORTED IMPERFECT PLATE STRIPS
A. van der Neut Aug. 1968 19 p refs
(VTH-152) Avail: CFSTI

The edges of an infinitely long plate strip are simply supported and free to move in the plane of the plate. The imperfection is assumed to be equal to the critical buckling mode and the investigation is confined to strain factors < 2 to 2.5, since the deflection is assumed to be equal to the buckling mode. The relations between the strain factor, the load factor and the stiffness reduction factor are established and have been given in graphs for various values of the imperfection. Author (ESRO)

N70-13729# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENTAL STUDY OF THE HYPERCRITICAL STATE OF CYLINDRICAL GLASS-REINFORCED-PLASTIC SHELLS COMPRESSED ALONG THE AXIS
V. S. Gumenyuk, V. S. Krauchuk, and V. V. Lushchik 31 Jan. 1969 11 p refs Transl. into ENGLISH from Mekhan. Polimerov (Russian), no. 5, 1967 p 894–899
(AD-694382; FTD-HT-23-976-68) Avail: CFSTI CSCL 13/13

The hypercritical stability of circular, cylindrical shells in axial compress shells are more suitable for investigating the post-buckling behavior of the shells. The final conclusion is that fiberglass shells are superior to metal shells for conducting experiments in axial compression with layer radial deformation. An experimental study of the hypercritical state of cylindrical glass-reinforced-plastic shells compressed along the axis. TAB

N70-13735# Columbia Univ., New York. Henry Krumb School of Mines.
LUDERS BAND PROPAGATION IN IRON Interim Technical Report
Karl M. Prewo (Ph.D. Thesis, May 1969 116 p refs
(Contract DA-31-124-ARO(D)-382)
(AD-693294; AROD-5642-3-MC) Avail: CFSTI CSCL 20/11

An experimental technique has been developed and used to study the dependence of plastic zone velocity on stress in low carbon iron and iron containing 3.2% Si. This technique involves the use of a specimen design which provides for the nucleation and propagation of only one Luders band in the specimen, thus enabling stress and observed deformation rates to be unambiguously related to band behavior. A stress relaxation procedure has made possible the separation of the applied stress into the sum of two parts: a stress characteristic of the condition of the material being tested and an effective stress dependent upon the velocity of the band in motion. It has been found that the velocity of a Luders band depends upon this effective stress in a way characteristic of other dislocation-dynamics descriptions. A model has been developed to relate the dynamics of Luders band motion to the average velocity of individual dislocations and the mobile dislocation density. Author (TAB)

N70-13782# Catholic Univ. of America, Washington, D.C. School of Engineering and Architecture.
STRESSES IN SOLID AND HOLLOW SPHERES SUBJECTED TO GRAVITY OR TO NORMAL SURFACE TRACTIONS
A. J. Durelli, V. J. Parks, and L. Ferrer Oct. 1969 32 p refs
(Contract Nonr-2249-(06))
(AD-694479; Rept-22) Avail: CFSTI CSCL 21/9.2

Stresses in a heavy solid sphere and in a heavy hollow sphere have been obtained photoelastically using the immersion analogy. With the use of the superposition principle, the solutions for the solid sphere and the hollow sphere subjected to diametral compression were derived from the gravitational solutions. The approach may be extended to any of the class of problems in which the surface tractions are normal to the surface. Author (TAB)

N70-13796*# Bell Aerosystems Co., Buffalo, N.Y. Structural Systems Dept.
APOLLO RCS POSITIVE EXPULSION TANKAGE PRODUCT IMPROVEMENT PROGRAM. TASK A: EVOLUTION OF APOLLO-TYPE POSITIVE EXPULSION PROPELLANT TANKAGE Final Report, Jul. 1967 – Sep. 1969
Robert K. Anderson and Elvin J. Ecelbarger 26 Sep. 1969 193 p refs
(Contract NAS9-7182)
(NASA-CR-102011; BAC-8514-927002) Avail: CFSTI CSCL 20K

A chronological summary of the evolution of the Command, Service, Lunar Module, and other related tankage is given. The useful operating lifetime of the Apollo Configuration RCS tanks is evaluated for a mission of extended duration with a specific goal of 12 months. Vibration testing of the Apollo type bladder with referee fluid is verified as representative of vibration testing with actual propellants. Elimination or reduction of bladder permeation and the associated problem of bubble formation within the bladder was attempted. An increase in the expulsion cycle life of the tank bladders was attempted by eliminating damage due to post-expulsion repositioning. R.B.

N70-13862# Norwegian Inst. of Tech., Trondheim. Inst. of Applied Mechanics.
A METHOD FOR SOLVING PROBLEMS OF NONSHALLOW SHELLS
Arvid Gustafson 1969 21 p refs ACTA Polytech. Scand., Civil Eng. Ser. 56
(PB-185623; APS-CI-56) Avail: CFSTI CSCL 20K

The method developed in this paper is an extension of the Vlasov theory for thin shells to include also shells with undamped solutions. By use of isometric coordinates the differential equations for the normal deflection and the stress function are transformed into an integral equation which may be solved by successive approximations. Author (USGRDR)

N70-13894# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POSSIBLE FORMS OF AXISYMMETRICAL LOSS OF STABILITY IN CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION
A. V. Dyatlov 14 Feb. 1969 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 6, 1967 p 42–45
(AD-693950; FTD-HT-23-1056-68) Avail: CFSTI CSCL 13/13

Experiments show that axisymmetric buckling of cylindrical shells compressed in the axial direction may be symmetric and antisymmetric with respect to the midsection of the shell. The experimental values of critical stresses for short cylindrical shells are only a fraction of the upper critical stress. It is theoretically shown that antisymmetric loss of stability is the only form possible for extremely short shells, the shell (or more precisely the ring) being turned inside out. An expression is derived for the relative longitudinal extension of the shell fibers at a given distance from the midsection of the ring. For sufficiently short shells, buckling begins immediately after application of the load with a resultant loss of stability due to development of plastic deformations or the axisymmetric (zonal) form of buckling is replaced by the nonaxisymmetric (tesseral) form. TAB

N70-13930# Sud-Aviation, Courbevoie (France). Lab. Structures Nouvelles.
INDUSTRIAL ASPECTS OF METAL BONDING WITH ADHESIVES [ASPECTS INDUSTRIELS DU COLLAGE DES METAUX]
Georges Jubé Sep. 1969 11 p In FRENCH Presented at the Colloq. at Valduc, France, 18 Apr. 1969 Its Etude No. 1089
Avail: CFSTI

A survey is presented of recent development in metal bonding with adhesives and its use in the industry as a common process. Some problems have to be resolved before adhesives become widely used. These include the selective heating of metal joints, up-dating of standards and optimization of structure design in relation to machining/adhesive joining. ESRO

N70-13950# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
THE INTERACTION OF LOCAL BUCKLING AND COLUMN FAILURE OF THIN-WALLED COMPRESSION MEMBERS
A. van der Neut [1969] 28 p refs Presented at the 12th Intern. Congr. of Appl. Mech., Stanford, Calif., Aug. 1968
(VTH-149) Avail: CFSTI

An analytical investigation is made of column failure of compression members susceptible to local buckling phenomena, including the effect of imperfections as to initial waviness of the composing flat elements and initial non-straightness of the column axis. Elastic behaviour has been assumed. Author (ESRO)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-12770*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THERMAL CONDUCTIVITY IN THE CASE OF A FINITE HEAT PROPAGATION RATE [K VOPROSU O TEPLOPROVODNOSTI PRI KONECHNOY SKOROSTI RASPROSTRANENIYA TEPLA]
V. V. Kharitnikov Washington NASA Dec. 1969 7 p refs Transl. into ENGLISH from Inzh-Fiz. Zh. (Moscow), v. 16, no. 4, 1969 p 737–741
(Contract NASw-1692)
(NASA-TT-F-12647) Avail: CFSTI CSCL 20M

The authors present the solution to the problem of the heat distribution along a rod with and without taking into consideration heat exchange with the surrounding medium assuming that the heat propagation rate is finite. The results show that the finiteness of the heat propagation rate affects only the initial period of the nonstationary section of the sample. Author

N70-12788*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSPORT PROPERTIES AT HIGH TEMPERATURES OF Co-2-N-2-O-2-Ar GAS MIXTURES FOR PLANETARY ENTRY APPLICATIONS
Jerry S. Lee and Percy J. Bobbitt (N.C. State Univ.) Washington Nov. 1969 114 p refs
(NASA-TN-D-5476; L-6395) Avail: CFSTI CSCL 20M

The equations and assumptions employed to compute the viscosity, thermal conductivity, and Prandtl number for high temperature gas mixtures which, at low temperatures, may be composed of arbitrary percentages of CO2, N2, O2, and Ar are presented. Ionization phenomena are not considered; the results are limited to pressures and temperatures where dissociation reactions dominate. Numerical results are obtained for three different atmospheric gas mixtures: air, 100 percent CO2, and a mixture of 43 percent CO2, 25 percent N2, and 32 percent Ar (by vol.).

Comparisons of the latter two mixtures with air and, also, of air and CO2 with the results of other investigations are given. In addition, transport properties computed from the full equations of the first approximation of the Chapman-Enskog rigorous kinetic theory are compared to those computed from first and second approximations to these equations. Author

N70-12818# Explosives Research and Development Establishment, Waltham Abbey (England).
FORCED CONVECTION HEAT TRANSFER TO SUPERCRITICAL CRYOGENIC HYDROGEN. PART 1: LITERATURE SURVEY
J. C. Beech 28 Feb. 1969 47 p refs
(AD-693361; ERDE-1/S/69; WAC/190/05) Avail: CFSTI CSCL 20/13

The published experimental data covering forced convection heat transfer to cryogenic hydrogen are reviewed, with special attention to the near-critical regions of temperature and pressure. Data for straight and curved tubes, of both circular and non-circular cross-sections, are covered; also the case of asymmetric peripheral heat flux through the walls. A number of theoretical and semi-empirical treatments of the near-critical, variable fluid property condition are discussed, and their effectiveness in correlation of near-critical heat transfer to cryogenic hydrogen considered. Author (TAB)

N70-12820# Bureau of Mines, Amarillo, Tex.
THERMODYNAMIC PROPERTIES OF A REDLICH-KWONG FLUID IN THE TWO-PHASE REGION
B. J. Dalton and Robert E. Barieau Dec. 1969 195 p refs
(BM-RI-7312) Avail: Issuing Activity

A computer program was developed for predicting thermodynamic properties, including those at the critical point, that are perfectly general and applicable to any equation of state. To demonstrate the efficacy of the method, this computer program was used to evaluate thermodynamic properties of a Redlich – Kwong fluid in the two phase region. Expressions for calculating various thermodynamic functions specific for this particular equation of state are derived. Numerical values are tabulated and graphs are presented for all functions calculated. It is shown that for a Redlich – Kwong fluid there are finite discontinuities in (1) the second temperature derivative of the Gibbs free energy or chemical potential at the critical point, (2) the second derivative of the vapor pressure curve with regard to the temperature on passing through the critical point, and (3) the measured heat capacity at constant volume on passing through the critical temperature when the calorimeter is filled to the critical density. It is also shown that the heat of vaporization is infinite for a Redlich – Kwong fluid at absolute zero. Author

N70-12857# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
APPLICATION OF FRACTURE MECHANICS TO THERMALLY STRESSED CYLINDERS USING A FINITE ELEMENT METHOD
G. J. De Salvo Mar. 1969 36 p refs
(WANL-TME-1897) Avail: CFSTI

A method for obtaining the thermal stress intensity factor for a hollow cylinder with internal heat generation is described. The model is chosen to represent a section around a cooling hole in the reflector of the NERVA reactor. The stress intensity factor is determined as a function of radial crack length for various heat generation rates, material properties and geometries. The stress intensity factor is related to the equivalent thermal stress at the inner wall. A comparison between this allowable stress and the stresses obtained from approximate mechanical models shows close agreement only for small crack lengths. In all cases the mechanical models give conservative estimates. Author (NSA)

N70-12860# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.
APPLICATION OF ADIABATIC CALORIMETRY TO METAL SYSTEMS Progress Report, 1 Sep. – 30 Jul. 1969
E. E. Stansbury and C. R. Brooks Jul. 1969 34 p refs
(Contract AT(40-1)-3291)
(ORO-3291-13) Avail: CFSTI

Activities directed toward assessment of the accuracy of thermo physical measuring techniques used in heat capacity determinations are reported. This program involves about 40 laboratories and measurements on pure Cu, Au, Pt, W, Al2O3, and stainless steel for intercomparison. Results on Au measured during the report period are included. Research on short-range ordering in Ni-base Cr alloys continued during the report period. Data are included on specific heat of Ni – Cr alloys having different compositions. In other work the heat capacity-temperature curve for disordered Ni3Fe was measured. Author (NSA)

N70-12931*# Auburn Univ. Thermoscience Group.
SATURATED SYSTEM BEHAVIOR: SURFACE BOILING AND CONTROLLED BLOWDOWN Final Report
G. H. Nix and R. I. Vachon Mar. 1969 225 p refs
(Contract NAS8-11234)
(NASA-CR-102345; Rept-10) Avail: CFSTI CSCL 20M

Two separate but related studies are reported on areas pertinent to an understanding of the behavior of saturated systems. The first is an experimental investigation of surface and static pressure effects on nucleate pool boiling. The second is an analysis of saturated system response to rapid and controlled depressurization. Pool boiling data were collected, at various system pressures, for chemically etched 304 stainless steel surfaces in contact with distilled water. Results show the changes in heat transfer with varying rms surface roughness and preparation techniques. Results of transient discharge tests are compared to a model developed for analysis and with results obtained by other investigators. The model agrees well with system pressures and temperatures, and predicts local time-dependent liquid and vapor properties within the vessel. Other models considered did not produce satisfactory agreement with the data of the present investigation. An explanation is given for pressure fluctuations that have been observed in discharging saturated systems. Author

N70-13088*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CRYOGENIC TANK SUPPORT EVALUATION Final Report
B. R. Bullard 1 Dec. 1969 156 p refs
(Contract NAS3-7979)
(NASA-CR-72546) Avail: CFSTI CSCL 20M

Thermal performance was determined, experimentally, on thermal models simulating six different tank support concepts. These concepts included a thermal disconnect, a heat block, a cooled strut, a filament wound fiberglass strut, a fiberglass cone segment, and a honeycomb segment. Liquid nitrogen and hydrogen were used for cold boundary temperatures and warm boundary temperatures were nominally 440 R and 540 R. The results were used to reevaluate system weights for LH2 and CH4 propellant tanks up to 15 feet in diameter. Author

N70-13108# Battelle-Northwest, Richland, Wash.
THERMODYNAMICS OF CARBON AND OXYGEN COMPOUNDS OF LIQUID SODIUM
Gerhard Hofer 5 Aug. 1969 10 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 60, May 1969 p 457 460
(BNWL-TR-40) Avail: CFSTI

The three-phase equilibria in the ternary system sodium carbon - oxygen were determined at 25, 667, 687 and 760 C by thermodynamic analysis. The activities for carbon and oxygen were calculated for the three-phase regions bordering sodium. Author (NSA)

N70-13202# Gottingen Univ. (West Germany). Inst. fuer Physikalische Chemie.

THE INFLUENCE OF INITIAL TEMPERATURE ON THE LIMITS OF DETONABILITY Final Report, 1 Jun. 1967 - 30 Jun. 1969

D. Pawel, H. Vasatko, and H. Gg. Wagner 30 Jun. 1969 69 p
(Grant AF-EOAR-49-67)
(AD-692900; AFOSR-69-2095TR) Avail: CFSTI CSCL 19/4

The influence of initial temperature (T(o) = 195K and T(o) = 295K) on the limits of detonability of gaseous detonations was investigated for mixtures of CH4 - O2, H2 - O2, and H2 - air at one atmosphere initial pressure in long tubes of 4, 6, 10, 16 and 26 mm inner diameter, respectively, by use of a rotating drum camera. Two experimental designs are described to measure these limits at low initial temperatures. The regime of fuel gas concentrations for stable detonations becomes somewhat narrower at lower initial temperatures. The influence of the initial temperature on the critical tube diameter is estimated. Furthermore, the applicability of the Chapman-Jouguet theory is discussed in relation to shock wave configurations, i.e. the Mach triple configuration. The essential arguments for the existence of the limits of detonability are discussed. Finally, a new method to estimate the limits of detonability with a very simple experimental arrangement is described. By this method experiments concerning the stability of a detonation and its initiation process are linked together. Author (TAB)

N70-13269# Louvain Univ. (Belgium). Lab. of Inorganic Chemistry.

REACTION KINETICS IN DIFFERENT TYPES OF DEFLAGRATIONS Final Scientific Report

A. van Tiggelen Oct. 1968 18 p refs
(Grant AF-EOAR-44-66)
(AD-678214; AFOSR-68-2634) Avail: CFSTI CSCL 21/1

Contents: theory of flame propagation; experimental investigation of laminar flames; explosivity of liquid reacting systems; turbulent burning velocity; emission of band spectra in hydrocarbon flames; burning mechanisms of solid propellants. TAB

N70-13320# Ohio State Univ., Columbus. Computer and Information Science Research Center.

THERMODYNAMICS AND INFORMATION: BEFORE, IN, AND BEYOND QUANTUM MECHANICS

Jerome Rothstein Dec. 1968 25 p refs
(Grant NSF GN-534)
(PB-183738; TR-68-5) Avail: CFSTI

A discussion of thermodynamics is presented, with quantum mechanics used only implicitly to guarantee the stability of matter. It is concluded that thermodynamics indicated the existance of entities, and led to the quantum theory, and may lead to a successor theory to the current quantum mechanics. F.O.S.

N70-13342# Bettis Atomic Power Lab., Pittsburgh, Pa.

WASP: A PROGRAM TO GENERATE WATER AND STEAM THERMODYNAMIC PROPERTIES Research Report

J. H. Murphy and J. A. Redfield Oct. 1968 25 p refs
(Contract AT(11-1)-GEN-14)
(PB-185713; WAPD-TM-839) Avail: CFSTI CSCL 20M

The WASP program uses a unique method to quickly calculate various water and steam physical properties over an extremely wide range. All of the operations carried out by the program correspond to locating a point on thermodynamic charts. Given a pair of coordinates, such as pressure and enthalpy, internal energy and density, pressure and quality, or pressure and temperature (and density if the input temperature is the saturation temperature), the remaining properties will be calcualted, along with saturation line properties. The program will treat any positive pressure, energy, enthalpy, or temperature and any density less than 71.0 lb/cu ft. Author (USGRDR)

N70-13371# Atomic Weapons Research Establishment, Aldermaston (England).

THE THERMODYNAMIC PROPERTIES OF ARGON PLASMA IN LOCAL THERMODYNAMIC EQUILIBRIUM, OVER THE RANGE 1 TO 30 ATMOSPHERES PRESSURE AND 6000 TO 60,000 DEG K TEMPERATURE

R. G. Turner and Winifred E. Worsfold May 1969 230 p refs
(AWRE-O-20/69) Avail: CFSTI; UK: 30s, 0d

The results of some computer calculations of equilibrium chemical composition and thermodynamic properties of ionized argon in local thermodynamic equilibrium (LTE) over the range of temperatures 5,000 to 60,000 K at 100 K intervals and 1 to 30 atmospheres pressure are given. Basically, this represents extension to higher temperature and pressures of work done by K. S. Drellishak et al. Author (NSA)

N70-13372# Institute of Technology, Helsinki (Finland).

A TRANSIENT HEAT CONDUCTION PROBLEM IN A SOLID WITH TEMPERATURE DEPENDENT THERMAL PROPERTIES

Harry V. Norden and Ilari Seppa 1969 35 p refs
(PB-186184; APS-CH-84) Avail: CFSTI CSCL 20M

A steam pipe is surrounded by a material with a square cross-section. From zero time the pipe is heated by saturated steam at constant temperature. The thermal properties of the material and the coefficient of heat transfer to the open air are temperature-dependent. This transient heat conduction problem is solved by using the Laplace transform and the relaxation method. It is shown how the Laplace transform can be applied, even though the thermal quantities of the problem are temperature-dependent. The temperature field is calculated numerically on an electronic computer and the results are presented both numerically and graphically. Author (USGRDR)

N70-13387# Kernforschungsanlage, Karlsruhe (West Germany).

HEAT OF FORMATION AND ENTROPY OF FORMATION OF PLUTONIUM CARBIDE [BILDUNGWAERME UND -ENTROPIE DER PLUTONIUMKARBIDE

V. V. Achacinskij [1969] 14 p refs Transl. into GERMAN from Russian Conf. Paper in GERMAN Presented at Panel Meeting to Discuss the Thermodyn. Properties of Uranium Carbides and Plutonium Carbides, Vienna, 9-13 Sep. 1968
(KFK-tr-281; CONF-680960-1) Avail: AEC Depository Libraries

The heats of formation for PuC0.87, Pu2C3, and PuC2 were calculated and compared with experimental data. The probable entropy values are also given. Author (NSA)

N70-13389# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMAL CONDUCTIVITY OF HELIUM-ARGON MIXTURES AT TEMPERATURES OF 196.66 TO 372.66 DEG K AND PRESSURES OF 0.1 TO 29.4 Mn/Sq M

Z. A. Rychkova et al 13 May 1969 8 p refs Transl. into ENGLISH from Gaz. Prom. (Moscow), v. 13, no. 2, 1968 p 35-37
(AD-694397; FTD-HT-23-4-69) Avail: CFSTI CSCL 20/13

The thermal conductivity of helium argon mixtures at 196.66-372.66 K and 0.1-29.4 x 10 to the -3rd power pressures are discussed. Thermal conductivity of mixtures containing 14.2, 29.5, 55.0 and 69.0 percent of He was measured by a method described earlier. The maximum error is 2 percent. Author (TAB)

N70-13497*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

OPTICAL INVESTIGATIONS OF METAL PARTICLES FROM NOZZLE FLOW INTO A VACUUM [OPTISCHE UNTERSUCHUNGEN AN METALLISCHEN PARTIKELN AUS DUESENSTROEMUNGEN INS VAKUUM]

C. Batalli-Cosmovici Washington NASA Nov. 1968 88 p refs Transl. into ENGLISH from Max-Planck-Inst. fuer Phys. und Astrophys. (Munich), May 1968 p 8-110

(Contract NASw-1692)
(NASA-TT-F-12689) Avail: CFSTI CSCL 20M

The creation of barium vapor clouds in space was simulated by experiments in a vacuum chamber in order to optimize the yield of barium vapor and to analyze the initial phase of cloud formation. Compressed barium copper oxide mixtures in different combinations were ignited in combustion chambers and the reaction products allowed to flow through a nozzle into a vacuum chamber for optical measurements. Results showed that during the first 10 m/sec small particles left the nozzle zone with velocities up to 800 m/sec; thereafter, larger particles with velocities up to 300 m/sec left. The maximum current angle indicated that many particles underwent strongest accelerations only outside of the nozzle. Integration of particle size distribution over exhaust time indicated that solidified particles consisted of a homogeneous mixture of barium, barium oxide, and copper. G.G.

N70-13528# European Atomic Energy Community, Petten (Netherlands).
THE MEASUREMENT OF WIGNER ENERGIES ON SOME GRAPHITES WITH A CALORIMETER [DIE MESSUNG VON WIGNER-ENERGIEN AN EINIGEN GRAPHITEN MIT EINEM KALORIMETER]
G. Kemeny, H. Rother, and G. von Birgelen Aug. 1969 15 p refs In GERMAN; ENGLISH summary
(EUR-4036-d) Avail: CFSTI

For purposes of comparison the stored Wigner energies on some types of graphite (two reactor graphites, pyrographite and two vitreous types of carbon) were measured by a direct calorimetric method. The main characteristic of the calorimeter is a constant heat flux with the additional condition of a constant temperature rise. The measurements covered the temperature range 80 – 500 C. The graphites had been irradiated at 40 – 70 C and 350 – 400 C. The maximum of the liberated energy varied dependent on respective type of graphite. Author

N70-13530# Thermo Electron Corp., Waltham, Mass.
THERMAL FLUX IN A RESEARCH PARAMETRIC CONVERTER
D Lieb 30 Jun. 1969 26 p
(Contract AT(30-1)-3874)
(TEE-3874-7; TE-4086-32-70) Avail: CFSTI

Performance data for the thermionic converter are in their most useful form if they are independent of geometry. The corrections required to establish constant surface temperature can be assumed to be linearly related to the input power to the emitter. Because of the lower values of heat flux associated with dynamic (as opposed to static) data techniques, maintaining constant surface temperatures is much simpler with dynamic methods. Comparisons of the data obtained from the two methods show excellent agreement (10 mV or better) throughout the range of useful operation. Results from heat balance tests indicated a preliminary value of 2.1 watts/A for electron heating of the collector. This value is somewhat lower than expected and may be suspect because of thermocouple calibration variations. However, the electron heating of the collector was found to be proportional to collector current over a wide range of operating conditions in the power producing region. Author (NSA)

N70-13594# Stanford Univ., Calif. Inst. for Plasma Research.
TURBULENT HEAT TRANSFER IN A CIRCULAR TUBE AT HIGH BULK-TO-WALL TEMPERATURE RATIO: AN EXPERIMENTAL STUDY
Larry Hyde Brim (Ph.D. Thesis) May 1969 168 p refs
(Grant NSF GK-2007)
(PB-184808; SU-IPR-291) Avail: CFSTI CSCL 20M

An experimental apparatus was designed and built for making local heat transfer measurements in the downstream region for cooled turbulent tube flow at high bulk-to-wall temperature ratios. Local heat transfer rates were obtained from measurements of the temperature distribution in the flow tube wall using calibrated thermistor probes. The relationship between the tube wall temperatures and the heat transfer rate to the inside tube wall was determined by a calibration which used a radiant electric resistance heater to supply heat to the inside surface of the flow tube. Author (USGRDR)

N70-13677# Sandia Corp., Albuquerque, N.Mex. Aerospace Nuclear Safety Dept.
FRAGMENT VELOCITY MEASUREMENTS FROM THREE PROJECT PYRO EXPERIMENTS
S. L. Jeffers Jun. 1969 18 p
(SC-DR-69-329) Avail: CFSTI

Several motion picture films of Project PYRO liquid propellant explosive experiments were reviewed to determine a fragment velocity profile. All events were in the 25,000-pound series. One was a LO2/RP-1 in-tank experiment, and two were LO2/LH2 drop tests. The fragments examined were limited to those traveling in an upward direction where they might damage a spacecraft mounted on a launch vehicle; because of the viewing distance, it was impossible to determine the origin or constitution of the fragments. It was also impossible to measure the velocities close-in to the detonation because the vicinity was obscured by the combustion products of the fireball. Only after the fragments had exited the fireball could their velocities be measured. The fragment trajectories were extrapolated backward into the fireball, and their velocities were determined 10 feet from the initial position of the upper dome. These velocities ranged from 190 to 3040 fps. Velocity distributions of the several fragments observed are plotted. Author (NSA)

N70-13700# Politecnico di Torino (Italy). Centro Studi Motorizzazione Agricola.
A SIMPLIFIED METHOD FOR THE EVALUATION OF VOLUMETRIC PERFORMANCE OF RECIPROCATING MOTORS [UN METODO SEMPLIFICATO DI VALUTAZIONE DEL RENDIMENTO VOLUMETRICO DEI MOTORI ALTERNATIVI, SUPPLEMENTO]
Alberto Beccari (Assoc. Tec. delle 'Automobile, Turin) Jun. 1969 11 p refs In ITALIAN
(Publ-20; QR-48-Suppl) Avail: CFSTI

A simplified calculation method is presented to determine the degree of air filling in piston combustion engines. An approximation is made in assuming incompressible flow in the intake ducts and the influence of this approximation is estimated. The calculation is carried out for each of the four strokes of the engine and results are presented in diagrammatic form. ESRO

N70-13708# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF NITROGEN. VOLUME 1: CONSTANT TEMPERATURE Technical Report, Jan. 1966 – Jan. 1969
Herbert S. Brahinsky and Charles A. Neel Arnold AF Sta., Tenn. AEDC Aug. 1969 155 p refs
(Contract F40600-69-C-0001)
(AD-693134; AEDC-TR-69-126-Vol-1) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for nitrogen from a temperature of 100 to 15,000K and from a log rho of -7.0 to 3.0, where rho is density in amagats. These data are tabulated at constant temperature with density incremented. The dependent parameters are Z (compressibility factor), E/RT, H/RT, S/R, log P, and Z*. Several sources were used in assembling the data. Author (TAB)

N70-13709# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF NITROGEN. VOLUME 2: CONSTANT PRESSURE
Herbert S.Brahinsky and Charles A. Neel Arnold AF Sta., Tenn.

AEDC Aug. 1969 213 p refs
(Contract F40600-69-C-0001)
(AD-692712; AEDC-TR-69-126-Vol-2) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for nitrogen from a log P of -7.4 to 4.8 and from a temperature of 100 to 15,000K, where P is pressure in atmospheres. These data are tabulated at constant pressure with temperature incremented. Author (TAB)

N70-13710# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF NITROGEN. VOLUME 3: CONSTANT ENTROPY
Herbert S. Brahinsky and Charles A. Neel Arnold AF Sta., Tenn. AEDC Aug. 1969 457 p refs
(Contract F40600-69-C-0001)
(AD-692713; AEDC-TR-69-126-Vol-3) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for nitrogen from an S/R of 11.6 to 133.0 and from a temperature of 100 to 15,000K, where S/R is dimensionless entropy. These data are tabulated at constant entropy with temperature incremented. Author (TAB)

N70-13738# California Univ., Livermore. Lawrence Radiation Lab.
TRUMP/XB2 COMPUTER PROGRAM FOR PROCESSING THE TRUMP THERMAL PROPERTY DATA COMPILATION
Arthur L. Edwards 9 May 1969 50 p ref
(UCRL-50663) Avail: CFSTI

An alphabetical material index, list of data sources, material-classification system, data-quality indicator system, and the data themselves are on computer cards and magnetic tapes. Processing options available with the TRUMP/XB2 program include (a) reading the material data, checking for various types of format errors, calculating tables slopes, calculating enthalpies from specific-heat tables, and writing out the input data, error diagnostics, and calculated data; (b) conversion of the material data to any desired unit system; (c) producing a secondary material data list from the master data list, including all the materials or only the materials on a material selection list; (d) producing graphs of specific heat and thermal conductivity vs temperature; and (e) any combination of these. Author (NSA)

N70-13787# Sandia Corp., Livermore, Calif. Aerothermodynamics Div.
ASSESSMENT OF THE PROPER BOUNDARY CONDITIONS AT THE OUTER EDGE OF THE TURBULENT BOUNDARY LAYER ON SPHERICALLY BLUNTED CONICAL BODIES
P. O. Witze and D. L. Hartley Sep. 1969 38 p refs
(Contract AT(29-1)-789)
(SCL-RR-69-67) Avail: CFSTI

An integral mass-balance technique is presented for determining the thermodynamic properties at the edge of a turbulent boundary layer in the region where the curved bow shock influences the flow. The importance of compressibility, the use of integral versus local methods, and the location of the virtual origin of the turbulent boundary layer are also discussed. Author (NSA)

N70-13790# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN FEATURES OF THE COMBUSTION OF COMPACT METALLIC MATERIALS
L. Ya. Nesgovorov 24 Apr. 1969 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latv. SSR, Ser. Fiz. i Tekhn. Nauk (Riga), no. 1, 1967 p 65–69
(AD-694402; FTD-MT-24-513-68) Avail: CFSTI CSCL 21/2

The features of the initial stage of combustion of compact metallic materials are examined. The mechanism of the process is proposed. Author (TAB)

N70-13807# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT CAPACITY OF A SUBSTANCE NEAR THE CRITICAL POINT OF LIQUID AND GAS
M. Sh. Giterman 20 May 1969 14 p refs Transl. into ENGLISH from Teor. Issled. v Obl. Fiziki. Tr. (USSR), No. 3, 1966 p 83–88
(AD-693858; FTD-MT-24-14-69) Avail: CFSTI CSCL 20/13

The presence of extrema of the heat capacity at constant volume, C (subscript v), in the supercritical region is explained by an assumption with respect to the special properties of C (subscript v) at the critical point. The behavior of the jump in the heat capacity on the coexistence curve is discussed. The behavior of C (subscript p) in the supercritical region is analyzed. These investigations make it possible to determine the parameters of the equation of state of a substance near the critical point. Author (TAB)

N70-13813# Ceskoslovenska Akademie Ved, Raz.
EXPERIMENTAL INVESTIGATIONS OF LOCAL HEAT TRANSFER COEFFICIENTS IN THE RING CHANNEL AND THE INFLUENCE OF ECCENTRICITIES IN THE TEMPERATURE FIELD
V. Sulc May 1967 59 p refs Transl. into GERMAN from CZECHOSLOVAKIAN Report UJV-1813
(KFK-TR-288; UJV-1813) Avail: CFSTI

The measurement of the effects of eccentricity on the value of the local heat transfer coefficients in ring channels in the region of the Re, Pr, and Pe numbers under the geometric conditions given showed that the local heat transfer coefficients differ very little and somewhat decreased with increasing width. Some reduction of the mean heat transfer coefficient is observed. Author (NSA)

N70-13861# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
RECENT EXPERIMENTAL RESULTS ON THE COMBUSTION OF ALUMINIUM AND OTHER METALS [RESULTATS EXPERIMENTAUX RECENTS SUR LA COMBUSTION DE L'ALUMINIUM ET D'AUTRES METAUX]
Marcel Barrère 1969 19 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on Gas-Solid Interactions, Wright-Patterson AFB, Ohio, 13–17 Oct. 1969
(ONERA-TP-735) Avail: CFSTI

The study of the combustion of metals has recently become important since they are used as a fuel in modern rocket propulsion systems. The ignition delay, burning time of metal particles, combustion efficiency and the nature of the combustion products are considered in this paper. The first part is devoted to the experimental techniques used for the study of metal combustion. Metal particle combustion and the combustion of metal wires are considered. For the first group some static methods were developed, the metal particle being attached to a holder but the more widely used technique makes use of the metal particles in a flow. In the second group, ignition is simple and combustion is easy to study. The analysis of combustion phenomena is done by cinemicrography, freezing the combustion on cold plates, spectrography, etc. A critical study of these various techniques is presented. The second part is a synthesis of the experimental results showing for each metal and in particular for aluminium, beryllium, magnesium and boron, the influence of various parameters, e.g. gas atmosphere, pressure and temperature, influence of surface conditions on the metal at ignition etc. The nature of the deposits is also discussed. From these results some combustion models are proposed and are dealt with in the third part. The fourth part relates to a study of combustion in a heterogeneous environment particularly when the metal is included in a propellant or in a solid fuel. The results are based on the study of the combustion of a metal in solid or hybrid propellant systems. Author (ESRO)

N70-13866# Chalmers Univ. of Technology, Goteborg (Sweden). Div. of Solid Mechanics.

TRANSIENT THERMAL STRESSES IN DISCS WITH A TEMPERATURE DEPENDENT YIELD STRESS

Hasse Odeno 1969 26 p refs ACTA Polytech. Scand., Phys. including Nucleonics Ser. 66

(PB-185836; APS-PH-66) Avail: CFSTI CSCL 20K

Equations are given for determining transient thermal stresses in a heat treated disk. The material of the disk is assumed to be elastic perfectly plastic, with a temperature dependent yield stress. The temperature is assumed to vary only in the radial direction. Application is made to the determination of stresses which arise when the rim surface of the disc is subjected to a rapid temperature increase. The stress distribution sequence and residual stresses are calculated for certain values of temperature increase and heating rate. In the numerical analysis the yield stress is assumed to be linearly temperature dependent. Author (USGRDR)

N70-13932# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).

RESPONSE TO A TRANSIENT REGIME OF THE COMBUSTION SURFACE OF A HETEROGENEOUS SOLID PROPELLANT [REPONSE A UN REGIME TRANSITOIRE DE LA SURFACE DE COMBUSTION D'UN PROPERGOL SOLIDE HETEROGENE]

Marcel Barrère 1969 40 p refs In FRENCH; ENGLISH summary Presented at the 2nd Colloq. on the Gas Dyn. in Explosions and Reaction Systems, Novosibirsk, USSR, 24–29 Aug. 1969

(ONERA-TP-748) Avail: CFSTI

The response of a solid propellant surface to a transient regime may be determined by the step technique and depending on the pressure build-up or drop conditions, combustion rates are obtained that are different from those of the permanent regime. The first part is devoted to defining a realistic theoretical scheme and the study of the thermal flux transmitted to the surface and the combustion rate under the above conditions. In the second part a homogeneous combustion zone is assumed and the conditions at the boundary used for determining the transfer function are given. Good results have been obtained when the heat flux received by the surface from the combustion depends on both the pressure and the combustion rate. The response time of the surface is such that the propellant heterogeneity cannot be ignored for it effects the energy transfer at the surface. The introduction of heterogeneity in the analysis is the subject of the third part. In particular the response of the oxidizer and of the fuel can be different, which entails a modification of the matter and energy exchanges between the surface and the gas. Author (ESRO)

N70-13940# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).

MELTING PHENOMENA AND SURFACE REACTIONS IN PROPELLANT COMBUSTION [PHENOMENES DE FUSION ET REACTIONS DE SURFACE DANS LA COMBUSTION DES LITHERGOLS]

Jean-Francois Lieberherr 1969 16 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on Gas-Solid Interactions, Wright-Patterson AFB, Ohio, 13–17 Oct. 1969

(ONERA-TP-736) Avail: CFSTI

The first models used in hybrid combustion studies were based upon heat transfer from a gas to an evaporating or subliming solid. Many disagreements between experiment and these simplified models have led to think that other mechanisms are involved. The possibility of a chemical surface reaction was rapidly considered, this reaction taking place at the surface or very close to it. Various models have thus been established and account reasonably for the experimental observations, except for those observed at ONERA on high regression rate hybrid fuels and on metallic hydrides. Although the surface reactions remain as an important mechanism the theoretical study presented here shows that they must not be connected to a simple vaporization model but to a melting mechanism, and to the subsequent liquid flow. It can then be shown that the regression rate is a strong function of B/Pr, the ratio of the enthalpy transfer parameter through the liquid layer to the Prandtl number of the liquid. The melting rate also depends on the gasification rate of the liquid but this rate must be large to have a noticeable influence. The melting rate has an inverse pressure sensitivity and the gasification rate a direct pressure sensitivity. It is difficult to imagine means which will destroy the liquid layer and promote the combustion efficiency, other then the already existing turbulators. A possible way is to make use as much as possible of the surface reactions and to avoid propellants which have too low a Prandtl number in the liquid phase. Another way would be to take advantage of the particular conditions under which combustion takes place in the injection zone. Author (ESRO)

N70-13955# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN ANALYSIS OF HEAT-INDUCED OSCILLATIONS AS A FUNCTION OF TEMPERATURE CHANGE

S. N. Nikolaev 7 May 1969 6 p refs Transl. into ENGLISH from Aspirantskikh Rabot. Mat. Mekhn. Fiz. (USSR), 1964 p 178–180

(AD-693851; FTD-HT-23-115-69) Avail: CFSTI CSCL 21/2

Calculation of the complex vibration frequency in a one-dimensional acoustical system containing a plane heat source is presented. It is assumed that the heat source intensity depends on the temperature and pressure. Relaxation equations containing a delay time are postulated for the heat source intensity under nonstationary conditions. The results are used to analyze the excitation of oscillations in the combustion of a CO-air mixture. Author (TAB)

N70-13971# Iowa State Univ. of Science and Technology, Ames.

MODIFIED PULSE TECHNIQUE FOR THE MEASUREMENT OF SPECIFIC HEATS

Ronald Edward Blough (M.S. Thesis) May 1969 63 p refs

(Contract W-7405-eng-82)

(IS-T-316) Avail: CFSTI

The technique involves heating a rod specimen to a steady state temperature by passing an ac current through it. The current is cut off and the resulting cooling curve monitored by an infrared microscope. The steady state power supplied to the specimen and the initial rate of temperature change as the specimen cools from the steady state temperature are measured. The heat capacity is calculated. The uncertainty based on the apparatus and method employed was calculated to be 4.0 to 5.0%. However, experimental results on tantalum and nickel exhibited a larger error with the heat capacity values 10.0 to 13.0% lower than the literature values. A study of possible sources for systematic error revealed that the measured power values were approximately 4.0 to 6.0% low because of an error in the measured current. It is felt that with improved instrumentation the systematic errors can be eliminated. Author (NSA)

N70-14037# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.

KNOCK IN MOTORS WITH CONTROLLED IGNITION: PRESENT DAY PROBLEMS OF INTERPRETATION AND MEASUREMENT. SUPPLEMENT Quarterly Report [LA DETONAZIONE NEI MOTORI AD ACCENSIONE COMANDATA: PROBLEMI ATTUALI DI INTERPRETAZIONE E DI MISURA, SUPPLEMENTO]

E. Antonelli (Assoc. Tec. dell'Automobile, Turin) Jun. 1969 13 p refs In ITALIAN

(Publ-114; OR-55-Suppl) Avail: CFSTI

The reaction kinetics of knock detonation in piston combustion engines are outlined and research directed towards suppressing knock is discussed. Electronic equipment is described which has been used in measuring knock phenomena. ESRO

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-12879# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
Jul. 1969 39 p refs
(PB-184982) Avail: CFSTI CSCL 05B

Contents: Continuously visible satellite constellations; Controlled destructive testing of pressure vessels; Problem notes in acoustics, chemistry, communications sciences, electronics, and metallurgy. USGRDR

N70-12898*# Indiana Univ., Bloomington. Aerospace Research Applications Center.
TOPICS ON URBAN PLANNING ANNOTATED BIBLIOGRAPHY
Joseph di Salvo and D. E. Lundgren [1969] 78 p refs
(Contract NSR-15-003-055)
(NASA-CR-107170) Avail: CFSTI CSCL 05B

Bibliographic references and abstracts which were announced between January 1965 and February 1968 are presented. The topics covered include the following: urban development, budgeting, and management; air pollution, and water pollution and supply; airports and industries; housing projects and slum clearance; Community Action Program; fire control; riot and crime prevention and control; and Job Corps, poverty, welfare, and unemployment programs. N.E.N.

N70-13005# British Iron and Steel Research Association, London (England). Operational Research Dept.
THE EVALUATION AND SELECTION OF RESEARCH PROJECTS
R. D. Reader and C.J. Beattie 1969 8 p
(PB-186165; OR/149167) Avail: CFSTI CSCL 05A

The report discusses the value of formal methods for the evaluation and selection of research projects, and shows that the practical applications of such methods can be of very great benefit to a research manager. Particular reference is made to the procedure currently used in the British Iron and Steel Research Association, Operational Research, Department for the choice of its annual research program. Author (USGRDR)

N70-13332# British Iron and Steel Research Association London (England). Operational Research Dept.
A NEW REPORT STYLE FOR COMMUNICATING TO INDUSTRY MANAGEMENT
C. J. Beattie 1969 6 p
(PB-186166; OR-44-67) Avail: CFSTI CSCL 05A

The report demonstrates the need for a new style of report for communicating to industry management, outlines the content and form of such a report, and mentions the probable consequences of using it. Author (USGRDR)

N70-13402# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS NO. 83
7 Nov. 1969 64 p Transl. into ENGLISH from Hungarian j.
(JPRS-49220) Avail: CFSTI

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1. BLOC COUNTRIES CONFER ON BLACK AFRICA PROBLEMS Peter Mandi p 1–3
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4. ACTIVITIES OF ACADEMY ORGANS HIGHLIGHTED Imre Egyed p 26–35
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7. FIRST INTEGRATED CIRCUIT SERIES DEVELOPED L. Schronk p 53–60 (See N70-13404 03-09)

N70-13847# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
Aug. 1969 32 p refs
(PB-185764) Avail: CFSTI CSCL 05B

Contents: Improving the diffracting properties of LiF: comparison with graphite; Acoustics; Atmosphere and astrophysics; Chemistry; Electricity; Mathematics; Metallurgy; Ocean technology; Optics; Radar; and Solid state physics. USGRDR

N70-13887# Library of Congress, Washington, D.C. Aerospace Technology Div.
SURVEY OF FOREIGN SCIENTIFIC AND TECHNICAL LITERATURE. HYPERVELOCITY PHENOMENOLOGY. PART 1: ANALYTICAL SURVEY. PART 2: COMPILATION OF ABSTRACTS
Alexis Baratoff 12 Nov. 1968 22 p refs
(AD-677927; ATD-68-78-110-1) Avail: CFSTI CSCL 19/4

Contents: Hypervelocity impact studies; Aeroballistic ranges and launchers; Experimental and measuring techniques; Compilation of abstracts. TAB

N70-13801# Politecnico di Torino (Italy). Centro Studi Motorizzazione Agricola.
ELEMENTS FOR CONDUCTING STUDIES OF ELASTIC SEATS IN CROSS COUNTRY VEHICLES [ELEMENTI PER L'IMPOSTAZIONE DELLO STUDIO DI SEDILI MOLLEGGIATI PER VEICOLI FUORI STRADA]
Giovanni Rosso Assoc. Tec. Automobile Jun. 1969 14 p refs In ITALIAN Sponsored by Consiglio Nazl. delle Ric. *Its* Ric. ATA, Quaderno 77, Suppl. to No. 6
(Publ-19) Avail: CFSTI

A general outline is given of the requirements for elastic seats on tractors and excavation machines and formulas are presented for the dynamic behavior of such seats. Several types of seats are compared and evaluated as to attenuation and easy manouverability of vehicles. ESRO

N70-13833# Commissariat à l'Energie Atomique, Bruyères-le-Châtel (France).
STUDY OF THE CHIMNEY PRODUCED BY AN UNDERGROUND NUCLEAR EXPLOSION [ETUDE DE LA CHEMINEE CREEE PAR UNE EXPLOSION NUCLEAIRE SOUTERRAINE]
Serge Derlich Oct. 1969 21 p refs In FRENCH; ENGLISH summary
(CEA-R-3851) Avail: CFSTI

Underground nuclear explosions lead to the formation of a cavity which is roughly spherical shaped. The roof of this cavity is unstable and collapses in most cases, leading to the formation of a chimney. The height and the diameter depend on the energy of the charge and on the nature of the surroundings. The chronology of the various stages can be determined by seismic observations. It is found that the interior of the chimney is filled, either partially

or completely, with rubble earth. This phenomenon is of great importance so far as the use of nuclear explosions for industrial applications is concerned. Author (ESRO)

N70-14058# Commissariat à l'Energie Atomique, Bruyères-le-Châtel (France).
STUDY METHODS FOR BORINGS CARRIED OUT NEAR THE UNDERGROUND NUCLEAR EXPERIMENTS IN THE SAHARA. PART 2: TECHNIQUES FOR STUDYING THE WALLS OF THE BORE-HOLES [METHODES D'ETUDES DES FORAGES REALISES AUTOUR DES EXPERIENCES NUCLEAIRES SOUTERRAINES AU SAHARA. DEUXIEME PARTIE: TECHNIQUES D'ETUDES DE LA PAROI DES FORAGES]
Jean Faure Oct. 1969 25 p refs In FRENCH; ENGLISH summary
(CEA-R-3762-2) Avail: CFSTI

The underground nuclear explosions at the Sahara test site have given rise to drilling methods which facilitate the study of the rocks by television and their permeability. After a presentation of the principle of the experiment, a description is given of the technique used, the equipment and its manipulation. Finally problems arising from the interpretation of the results are considered. The conclusion stresses the importance of the results for possible industrial applications. Author (ESRO)

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